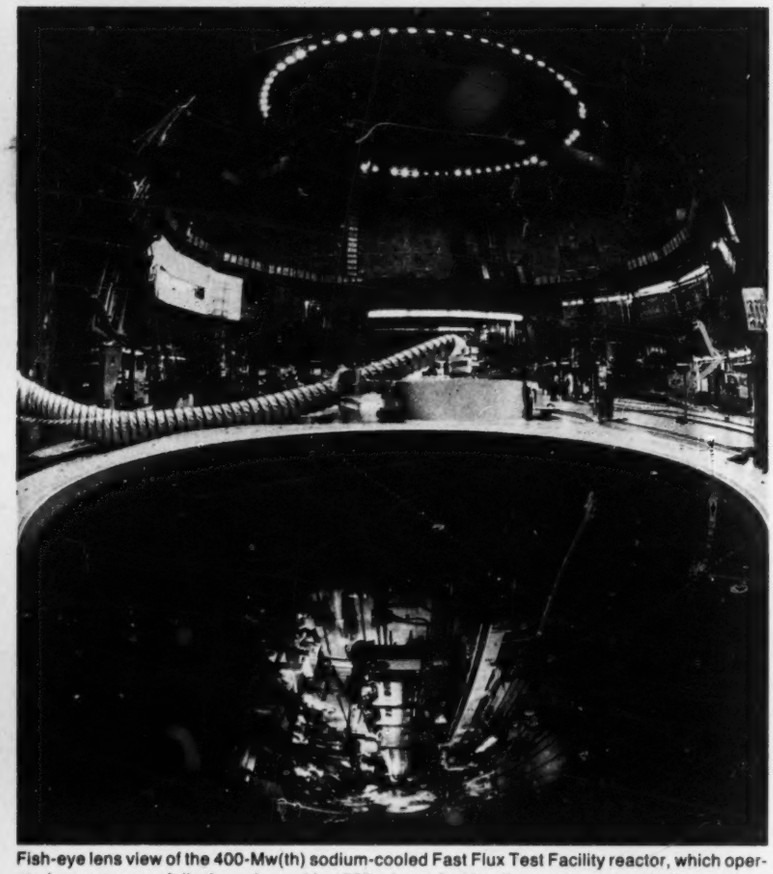
4/13/87 C6985-6

Volume 65, Number 2
February 1987

# Electric Light & Power

THE NEWS MAGAZINE OF ELECTRIC UTILITY MANAGEMENT AND TECHNOLOGY

A PENNWELL PUBLICATION



Fish-eye lens view of the 400-Mw(th) sodium-cooled Fast Flux Test Facility reactor, which operated more successfully than planned in 1986, shows fuel loading equipment and other apparatus on the reactor's operating floor and, below floor level, a view into the 55-ft vertical interim examination and maintenance cell where test assemblies are initially examined after irradiation. The FFTF achieved an Operational Efficiency Factor of 98 percent in 1986.

## FFTF exceeds 1986 operational goals

RICHLAND, WA—The Fast Flux Test Facility at Hanford, WA, exceeded its operational performance goals in 1986. The advanced test reactor achieved an Operational Efficiency Factor of 98 percent, 3 percent better than the 1986 goal set for it.

The Operational Efficiency Factor is a measurement of the time the unit was operating "on mission."

According to FFTF plant manager Charlie Peckipaugh, vice president of Westinghouse Hanford Co., contract operator of the Department of Energy facility, "We had an exceptional year of operation at the FFTF, and reaching our goal of 95 percent is certainly a reflection of the high degree of reliability of the plant."

Continued on page 23

## Long-term industry outlook improving, says EIA report

WASHINGTON—Investor-owned electric utilities will experience low growth and declining costs from now until 1995, according to an Energy Information Administration report.

The study says the financial condition of the industry as a whole should improve as a result of smaller construction expenditures.

In the report, entitled *Financial Analysis of Investor-Owned Utilities*, EIA said sales for investor-owned companies are expected to grow at an average of 2.6 percent per year from 1985 to 1995. (See table.)

EIA's forecast was based on a 2.8 percent per year GNP growth rate and an inflation rate of 5.2 percent per year. The group said its GNP prediction is below the assumed growth rate for the period.

"The fact that the GNP is expected to grow faster than electricity sales is striking," states EIA in the report, "because historically the rate of growth of electricity sales has outstripped the growth in GNP."

### Revenues should increase

Revenues should also increase during the period, said the report. However, sales are expected to increase more rapidly. Production expenses per unit of sales are projected by EIA to decline between 1985 and 1995.

According to EIA, the only expense projected to increase is fuel because oil and gas will be in greater demand.

Continued on page 23

## New tax laws will result in rate cuts for many utilities

Don Minner
Associate Editor

BARRINGTON, IL—Lowering of the federal corporate tax rate this year and in 1988 has spurred many electric utilities to pass on the savings to customers by lowering their base rates.

Utility corporate income tax rates will be reduced from 45 percent to 40 percent this year, and 34 percent in 1988.

Some utilities are voluntarily asking state commissions for permission to make the reductions, while other companies are feeling pressure from consumer groups and state legislators to follow suit.

For example, New York Gov. Mario Cuomo ordered the state Consumer Protection Board (CPB) to seek $2.15 billion in rate decreases over the next two years for New York's major electric, gas and telephone electric utilities.

A petition filed by the CPB on behalf of the governor with the state public service commission asks for immediate temporary rate reductions to reflect both the utilities' corporate income tax savings and lower cost of capital, followed by hearings to determine the permanent level of the rate decreases.

Cuomo said the cuts are necessary to reflect 1987 and 1988 savings totaling $667 million resulting from changes in the federal corporate income tax rate and an additional $741 million in both years due to sharp decreases in the cost of capital.

"The utilities will receive major windfalls resulting from the Tax Reform Act of 1986," said the governor. "It is essential that the benefits of tax reform be passed on to ratepayers as soon as possible."

Under the new tax laws, Cuomo's office estimates that New York utilities will save approximately $232 million in 1987 and $435 million in 1988.

"During the last fifteen years, utility cost increases resulting from rapid inflation rates and abnormally high interest rates were continually passed on directly to ratepayers," stated the governor. "Now that the new federal tax law will result in windfalls to most of the state's utilities, consumers should see immediate benefits in the form of rate reductions. Simple fairness mandates this result."

CPB Executive Director Richard M. Kessel said his group also is asking the PSC to reduce the cost of capital for all utilities due to the declining cost of money.

The agency estimates that 1987 rate reductions would be: Central Hudson Gas & Electric ($25.1 M), Consolidated Edison ($154.1 M); LILCO ($51.0 M); New York State Electric & Gas ($57.2 M); Niagara Mohawk ($137.0 M); Orange & Rockland ($20.1 M); and, Rochester Gas & Electric ($21.3 M).

Edison Electric Institute Vice President of Finance and Regulation Dick Braatz told *EL&P* that the lowering of the corporate tax rate is not the only reason for the increase in

Continued on page 6

## DOE asks for 10 percent increase in FY 1988 budget

WASHINGTON—Increases in general science research, clean coal technology, environmental protection and defense activities are part of the U.S. Department of Energy's Fiscal Year 1988 budget request.

DOE said it will ask for $13.9 billion, up from $12.6 billion appropriated in FY 1987. With carryover funds and adjustments, the actual spending levels will remain unchanged: $14.0 billion in 1987 and $14.1 billion in 1988.

Under Secretary of Energy Joseph F. Salgado said the proposed budget "fully meets the department's obligations to support overall deficit reduction under Gramm-Rudman by holding the line against spending increases and by moving forward with efforts by President Reagan and Energy Secretary John S. Herrington to better target and manage federal dollars."

DOE proposed a 13 percent increase in funding for general energy science research. The budget for the Office of Environment, Health and Safety was increased from $62 million to $70 million.

For the clean coal program, DOE asked for a $350 million program over the next five years, with $50 million in 1988 and $100 million in 1989.

Salgado also said DOE will work with Congress and others to divest department activities more appropriately operated by the private sector. DOE will ask Congress to authorize a study of divesting the Southeastern Power Marketing Administration, and he said efforts will continue to sell the Alaska Power Marketing Administration.

DOE will ask Congress to rescind $256.7 million in the areas of solar ($13.1 million), university programs ($68.7 million), conservation R&D ($18 million), conservation grants ($112.4 million), and fossil energy ($44.5 million). The funds were not requested in FY 1987.

### Major objectives

"The major objectives of our budget," said Salgado, "are to provide strong and effective energy and national security leadership for the nation. We will meet the es-

Continued on page 6

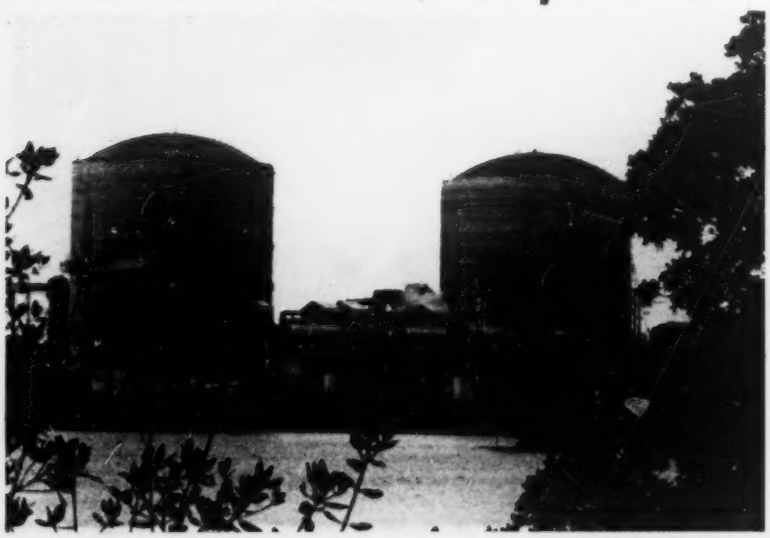
# News Briefs

JILL MINNER, Assistant Editor

### 'High degree' of safety in radioactive materials transport: ANS

● According to a new policy statement made by the American Nuclear Society, a high degree of public safety is assured by the current regulations for the transportation of radioactive materials. *Radioactive Materials Transport, A Policy Statement of the American Nuclear Society,* points out that the record for transporting radioactive materials has been excellent for the past 30 years, and that more than 5000 spent fuel assemblies have been shipped in this country since 1964 without mishap. ANS also recommends that: 1) States and local jurisdictions should not enact legislation that conflicts with or overlaps federal regulations; 2) The appropriate federal agencies should continue to periodically review existing regulations, updating them where necessary; and 3) Government, private sector and professional/technical society efforts should be increased to provide the public with factual, understandable information on the very low risks involved in transporting the materials.

## *FP&L's St. Lucie nuclear plant celebrates decade of operation*



Florida Power & Light Co.'s St. Lucie nuclear plant has marked ten years of record-setting commercial operation, according to the utility. FP&L said Units 1 and 2, which began operating in 1976 and 1983 respectively, have generated more than 65 billion kWh of electricity. The utility estimates that the two 839-MW units have saved FP&L customers $1.8 billion in fuel costs since 1976. "Every day these nuclear power plants are operating, FP&L customers save money. Electricity generated by our nuclear units costs about one-third as much as electricity generated by burning oil," said FP&L Group Vice President of Nuclear Energy C.O. Woody.

# In This Issue


**Editorial** ..... 4

**Calendar** ..... 9

**A central Illinois utility found itself in a jam** when wood poles it had ordered could not be delivered on time. Here's how the problem was solved.**T/D** . 16

**What did Bonneville Power do when it needed an insulated data link** for the optical transmission of alarms, control commands and analog signals to and from a high voltage site? Read about their solution.**T/D** ..... 16

**A new system can save utilities hundred of thousands of dollars annually** by helping them manage their capacitor placement programs. One utility's experience is described.**T/D** ..... 16

**An investigation into the current team skills training practices** used by government and industry yields a new training approach.**G** ..... 25

**Find out why many utilities are now using fundamental skills training** as the core of their training programs.**G** ..... 25

**A combination CRT/panelboard simulator** has been developed as a training tool for power plant managers.**G** ..... 25

**Readers' Service** ..... 27

**New Products** ..... 29

**New Literature** ..... 31

**Regulatory Review** ..... 32

**Personnel** ..... 33

**Management Methods** ..... 34


EL&P readers whose responsibilities include both Generation and Transmission/Distribution receive both technology sections. Other readers receive the technology section that applies to their respective area of responsibility. The Generation edition is indicated by a single dot (•) in the upper right corner of page 1; the T/D edition carries two dots (••). All readers receive EL&P's industry news section.

### Eastern Utilities Assoc. acquires energy management firm

● Eastern Utilities Associates (EUA) announced that it has acquired Citizens Heat and Power Corp. from Citizens Energy Corp. of Boston. The new subsidiary, renamed EUA Cogenex Corp., provides energy management and cogeneration services to commercial and institutional energy users. "EUA Cogenex gives us an excellent opportunity to supplement and expand EUA's present efforts in the conservation and cogeneration areas...," said EUA Chairman and CEO John F.G. Eichorn, Jr. EUA has appointed former Citizens Heat and Power Executive Vice President Joseph S. Fitzpatrick as president of EUA Cogenex. Fitzpatrick described the new subsidiary's service as a "no-risk situation for our customer. We pay the capital costs of the installation and guarantee savings. We are paid only if what we install really does reduce energy bills."

### Niagara Mohawk EDR program helps create/retain 3,000 jobs

● Niagara Mohawk Power Corporation's economic development rate (EDR) program has been credited with helping create or retain 3,100 jobs at 49 companies throughout upstate New York, according to Niagara Mohawk Director of Economic Development Edward J. Kearney, Jr. The utility said the EDR is a three-tier discount offered to existing industrial customers who increase load and to new customers. It is based on the total of actual usage, fuel adjustments and gross revenue taxes. Started more than two years ago, the program was designed to attract new business to the Niagara Mohawk service territory and to encourage the expansion of businesses already there.

### NHA to hold national 'future of hydro' conference

● The National Hydropower Association (NHA) said it will sponsor a conference on what the future of hydropower development will be after enactment of the Electric Consumers Protection Act. The conference is scheduled for March 16-17, at the Washington Plaza Hotel in Washington, D.C. Over 25 speakers from investor-owned utilities, public entities, independent developers, major engineering and consulting firms, legal experts and FERC staff will examine the uncertainties created by changes to the law and analyze the implications for original licenses and relicenses, according to NHA. For more information, contact National Hydropower Association, Department C, 1133 21st St., N.W., Suite 500, Washington, D.C. 20036.

### NSPE celebrates 37th National Engineers Week

● The National Society of Professional Engineers will celebrate its 37th National Engineers Week on February 22-28. The theme for the week, "Engineers: Turning Ideas Into Reality", is intended to highlight the image of the engineer as an innovator, according to NSPE. In a message to the nation's engineers, President Reagan said, "Our nation will continue to count on your talent and technological skill to help achieve continued domestic prosperity, national security, and a strong competitive position in world markets."

### WPSC Kewaunee nuclear plant sets national reliability record

● Wisconsin Public Service Corporation's (WPSC) Kewaunee nuclear power plant recently set a U.S. nuclear industry reliability record, according to the utility. WPSC said the 535-MW pressurized water reactor exceeded 200 continuous days of operation for the fifth time in its 12-year history. "What this means is reliable, low-cost electricity for customers of Wisconsin Public Service," stated WPSC Vice President of Nuclear Power Don Hintz, "We are very proud of our plant staff and of the work they are doing."

### AWEA says wind energy still growing despite obstacles

● The American Wind Energy Association (AWEA) reported that California's wind industry continued to grow during 1986 despite the loss of favorable tax benefits and the fall in world oil prices. AWEA estimates that nearly 2,000 wind turbines, worth about $200 million, were erected in California in 1986. Although that is less than half the number installed during 1985, AWEA considers it a milestone. "Skeptics predicted we would all blow away at the beginning of the year with the loss of the energy tax credits," said AWEA West Coast Spokesman Paul Gipe, "But we're still here, and we're expanding—against even greater odds than we anticipated a year ago."

### Solar generating system placed in service on SCE energy grid

● Luz International Ltd. said its third commercial scaled thermal solar electric generating system (SEGS) has been placed in service on Southern California Edison's energy grid. The $104-million, 30-MW project joins two other SEGS systems that are already in operation. The company said that two more 30-MW systems are scheduled for service this year.

### TVA seeks proposals for biomass research

● The Tennessee Valley Authority (TVA) is seeking research proposals from private industry, universities and others for biomass energy development, according to Phillip C. Badger, manager of the TVA's southeastern regional biomass energy program. TVA said the Department of Energy will provide about $300,000 in funding for the program, which is designed to promote commercialization and use (by the private sector) of biomass fuels—wood, farm crops and certain residues and wastes. "Proposed projects should have broad applicability in the 13 southeastern states," noted Badger. For more information on submitting projects contact Phillip C. Badger, TVA, Muscle Shoals, AL 35660, or phone (205) 386-3086.

# Survey says California spends more on conservation

PHOENIX—California spends the most money on energy conservation programs, according to a recent survey from the National Association of Regulatory Utility Commissioners (NARUC).

The group's Energy Conservation Committee released results of its survey of energy conservation, load management and small power producer activities in the fifty states. Individual state responses were developed in the fall of 1984 to the early spring of 1985. Sam Swanson of the New York Public Service Commission served as chairman of the Energy Conservation Subcommittee, which conducted the research.

The report showed that California spent $390 million on a state-wide basis on end-use efficiency in 1984. Other states that reported total annual utility expenditures were Florida ($100 million), Illinois ($50 million), New York ($40 million), and Wisconsin ($30 million). See table. NARUC cautions that the figures are not totally comparable.

### Expenditures

Measuring utility expenditures on end-use efficiency as a percentage of total revenue, the survey says California (1.95%) and Florida (1.7%) stand out above all others. States reporting the smallest relative expenditure were Iowa (0.03%) and North Dakota (0.05%).

NARUC discovered that almost half of the state public utility commissions have no policies regarding conservation. In a summary of the report, the committee said, "Few states have developed methodologies for determining the cost effectiveness of conservation programs. Many state commissions lack the capability for evaluation. Some state commissions have left the determination in the hands of utilities while other states are evaluating pilot program results."

Generally, pointed out the survey, states just beginning programs start with the most proven energy savers like residential energy audits.

| State | [illegible] |
|---|---|
| California | 1.95 |
| Connecticut | 0.1 to 0.4 |
| District of Columbia | 0.17 |
| Florida | 1.7 |
| Iowa | 0.03 |
| Maryland | 0.5 |
| New Jersey | 0.4 to 0.7 |
| New York | 0.4 |
| Nevada | 0.44 |
| North Dakota | 0.05 |
| Oklahoma | 0.68 |
| Oregon | 0.3 |
| Texas (electric only) | 0.3 |
| Virginia | 1.0 |
| Wisconsin | 0.81 |

Source: Rick Morgan, District of Columbia Public Service Commission
Gordon Dunn, Iowa Commerce Commission

The subcommittee found that commission orders and decisions regarding conservation and load management programs have evolved on a case-by-case basis. It said few states have issued a specific policy for the purpose of outlining their positions on the programs.

About 26 percent of the survey respondents said they had separate policies for gas and electric conservation expenditures, the primary reason being the difference in gas and electric economics.

Of those responding, most commissions said they base their avoided cost calculations in the short run on energy only, and long run costs on both energy and capacity.

### Actual savings

Not many of the states provided data concerning actual savings from conservation programs. California said its 1984 programs saved the equivalent of 9.5 million barrels of oil and reduced peak load by 758 MW. Florida estimates its annual savings because of the programs to be $1 billion.

"Other states submitted more general responses but supported the fact that conservation programs usually realize substantial energy savings," noted the survey. "Other benefits mentioned were deferred capacity, better management of capacity growth, lower peak demand than forecasted, increased public awareness and improved relations between customers and utilities."

For more information on NARUC's survey, contact Sam Swanson, NARUC Energy Conservation Subcommittee, c/o New York Public Service Commission, Three Empire State Plaza, Albany, NY 12223.

HOW TO PUT THE RIGHT PERSON IN THE RIGHT PLACE AT THE RIGHT TIME.

*The dispatcher's dilemma.*

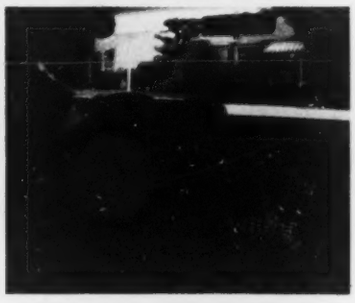
Trucks on the move. Service calls 'round the clock. Customers not at home. Add radio channel congestion, traffic, or weather problems and your service schedule is out of control.

MDI's Utility Dispatch System puts you back in control, by keeping you in constant touch with your drivers. When a service call is received, you can display, up to the second, geographical fleet status. So you can choose the best vehicle for the job. Work Orders are displayed on the MDI terminal right in the truck. No delays from unoccupied vehicles or error-prone conversations and repetitions.

A 'call ahead' key even advises the customer of arrival time, and avoids a wasted 'can't get in' call.

But improving customer service is just the beginning. MDI systems quickly pay for themselves by slashing paperwork. Making efficient use of resources. And providing greater job satisfaction to service personnel.

From proposal, through implementation, to on-going project management support, complete solutions have made MDI the leader in utility mobile data communication systems. Call MDI at (800) 663-8376. And let us put the right system in the right place at the right time. For you.



Mobile Data International, Inc.,
Corporate Headquarters,
11411 Number Five Road
Richmond, B.C., Canada V7A 4Z3
(604) 277-1511.

MOBILE DATA INTERNATIONAL

Inquire R.S. 2


## Delaval sold; new name Imo Delaval

LAWRENCEVILLE, NJ—Transamerica Delaval Inc. announced that it has been spun off by Transamerica Corporation to Delaval's shareholders.

At the same time, Delaval Chairman and CEO W.J. Holcombe announced the company's name has been changed to Imo Delaval Inc.

"We see Imo Delaval as more than a new name for an established company," said Holcombe. "For 85 years we have built a tradition of product excellence, innovative designs and quality workmanship."

## Long-term industry outlook . . . from page 1

"As a result," noted the report, "electricity prices are expected to decline in real terms at the rate of almost 1 percent per year."

Because existing generating capacity should be able to handle the load, the study predicts construction expenditures to decline approximately 6 percent per year during the period, from $24 billion in 1985 to $13 billion in 1995.

Said EIA, "Because construction expenditures largely determine a utility's internal cash flow, the financial position of the industry is expected to improve noticeably during the period."

### Extra cash

EIA believes the electric utility industry will have extra cash during the ten-year study period, allowing it to diversify or buy back invested capital. The report estimates that a net of $5 billion in external financing will be bought back between 1986 and 1995.

The improving state of the utility industry's financial health may lead to more diversification, according to the report. It said that as long as ample cash flow is available, diversification activities can be expected to continue.

"Although the general financial condition of the industry is expected to improve," stated EIA, "individual companies may use mergers to solve financial problems."

The study points out that mergers may occur among firms affected by nuclear construction problems. Also, large utilities may buy small ones and small ones will merge.

"However," added EIA, "many mergers among large firms are not expected because of poor economics, regulatory delays, and personal conflicts."

**PROJECTED FINANCIAL DATA FOR INVESTOR-OWNED ELECTRIC UTILITIES, 1985, 1990, AND 1995**

| Components | 1985 | 1990 Base Case | 1990 High-Economic-Growth Case | 1995 Base Case | 1995 High-Economic-Growth Case |
|---|---|---|---|---|---|
| Revenue (billion dollars) (Annual percent change from 1985) | 130.4 | 147.2 (2.5) | 151.2 (3.0) | 155.7 (1.8) | 166.7 (2.5) |
| Sales (billion kilowatthours) (Annual percent change from 1985) | 1,890 | 2,154 (2.6) | 2,224 (3.3) | 2,454 (2.6) | 2,576 (3.1) |
| Price (1985 mills per kilowatthour) (Annual percent change from 1985) | 68.0 | 67.6 (-0.1) | 67.2 (-0.3) | 62.9 (-0.8) | 64.1 (-0.6) |
| Construction expenditures (billion dollars) (Annual percent change from 1985) | 24.3 | 19.1 (-4.7) | 20.3 (-3.5) | 12.9 (-6.1) | 18.7 (-2.6) |

Source: Financial Analysis of Investor-owned Electric Utilities—Energy Information Administration.

## TVA provides job training, retraining to 20,000 workers

KNOXVILLE, TN—The Tennessee Valley Authority estimates that nearly 20,000 people in 400 industries have received job training and retraining under its Skills and Education Development programs.

According to the utility, this represents over $400 million a year in potential earnings for these workers.

"TVA's Skills and Education Development programs are driven on the premise that a properly trained and educated labor force is essential for true economic development," stated TVA Program Manager Dennis Mynatt.

The programs include high technology, upgrade craft and industry-specific training as well as education demonstrations.

TVA said its high technology demonstration program covers robotics, microelectronics, computer aided design and manufacturing and telecommunications.

The authority's upgrade craft training program is designed for journeymen who have the basic skills of their craft, but have been unable to keep up with the latest technological developments.

The education demonstrations include faculty upgrading, computer-managed interactive video, laser videodisc, telecommunications, education refinement, youth career training and curriculum development.

### Most important resource

TVA recognizes that its " most important resource [is] its people," stated Mynatt, "Nothing is more important for TVA and the nation than the development of its human resource."

## Letters . . . from page 4

have done the same thing.

I tip my hat to Minnesota Power, a company whose forward-thinking is unmistakably presented in the *EL&P* Utility of the Year article, yet is a company that treasures its heritage. Of this we all might take notice.

*Peter Kushkowski*
*IR Consultant*
*Northeast Utilities*
*Berlin, CT*

## DOE picks manager for Hanford site

PITTSBURGH—Westinghouse Hanford Company, a Westinghouse subsidiary, and the Boeing Company were selected by the U.S. Dept. of Energy in December to manage the Hanford advanced energy research and defense production site in Washington state.

Dr. William M. Jacobi, president of the Westinghouse Hanford, said, "Our primary objective will be to demonstrate the highest standards of safety and performance at Hanford. We are totally committed to safety first—without compromise—and to excellence in all we do."

### Phase-in period

The company will work with DOE's Richland, (WA) Operations Office during a phase-in period leading to actual takeover of Hanford operations.

Under the new arrangement, Boeing Computer Services will be the prime subcontractor to Westinghouse Hanford, with responsibility for managing information resources, computer resources, telecommunications, graphics and photographic services.

### Activities include

Activities at Hanford include advanced reactor development, civilian waste management, defense materials production, and defense waste management. The site is the location of DOE's Fast Flux Test Facility (FFTF), where research is being conducted to develop liquid metal reactor technology.

## FFTF 1986 goals . . . from page 1

During the year, the test reactor recorded a number of other achievements, including:

- A complex series of safety tests in July that involved 29 reactor startups and shutdowns to verify the passive safety of liquid-metal reactors. Part of this testing focused on a new safety feature that automatically cuts off reactor power if the flow of coolant is lost and normal reactor shutdown does not occur. The device, a Gas Expansion Module (GEM), performs the necessary actions to protect the reactor from overheating and safely brings the reactor under control.

### New test program

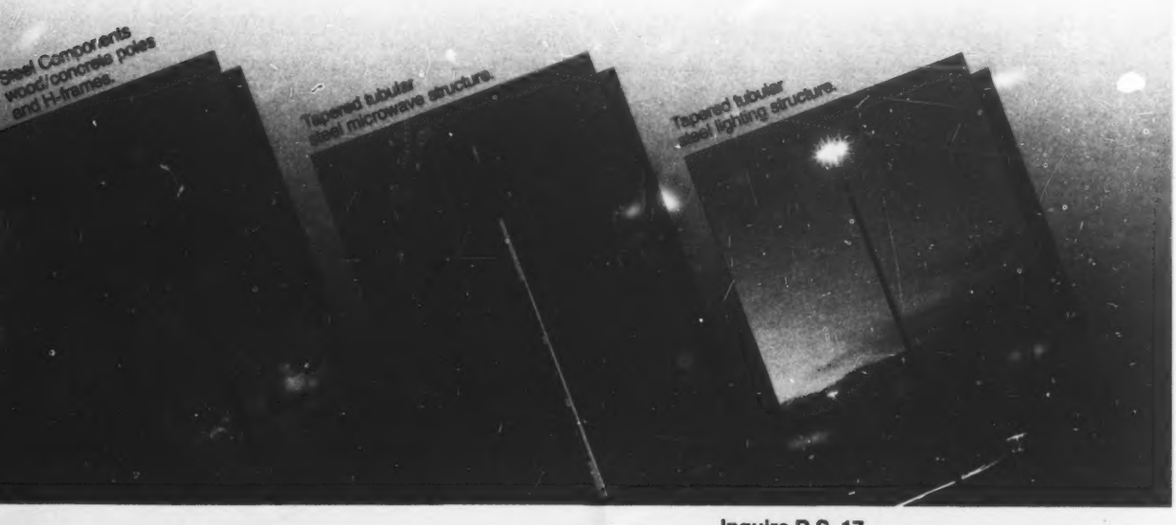
- Start of a new test program to demonstrate reactor core components that could operate up to three times longer than current types of advanced reactor components, greatly reducing refueling needs in future liquid-metal reactors. The test program involves long-term irradiation of test assemblies that include special materials and designs, advanced fabrication techniques and semi-automated production.
- Production of radioactive elements used for medical and commercial purposes, including Gadolinium-153 and Cobalt-60. Gadolinium-153 is a working ingredient in an advanced bone-scanning device that can detect and track the progression of osteoporosis, a crippling brittle-bone disease. Cobalt-60 is used in sterilization of medical products and equipment and also has the potential for food irradiation.

### Irradiation tests

- Other irradiation tests involved a variety of fusion materials specimens, candidate materials for space reactor applications and structural materials tests for advanced reactor technology.


LEADERSHIP & INTEGRITY

FL INDUSTRIES, INC.
MEYER INDUSTRIES DIVISION
PO BOX 114
Red Wing, MN 55066
715-792-2811


Steel Components wood/concrete poles and H-frames.
Tapered tubular steel microwave structure.
Tapered tubular steel lighting structure.

Inquire R.S. 17

-C6985-6
4/13/87

Volume 65, Number 4
April 1987

# Electric Light & Power

THE NEWS MAGAZINE OF ELECTRIC UTILITY MANAGEMENT AND TECHNOLOGY

A PENNWELL PUBLICATION

## PNM considers plan to place distribution system in limited partnership to help lower rates

ALBUQUERQUE, NM—Public Service Company of New Mexico (PNM) said it is considering the possibility of placing its electric distribution system in a limited partnership that would have assets of about $400 million.

The utility has been exploring ways to restructure in order to meet recently elected New Mexico Gov. Garrey Carruthers' goal of lower utility rates. New Mexico's first republican governor in 15 years set a goal of an immediate $35 million rate reduction to make the utility competitive with neighboring companies.

"We need to strike a balance between the needs of the ratepayers and PNM's investors," said PNM Senior Vice President and Chief Financial Officer A.J. Robison. "In formulating the reorganization program, considerable attention must be and is being given to protecting and enhancing our investors' values while attempting to meet Gov. Carruthers' goals."

### Central feature

According to PNM, the central feature of its reorganization concept would be the separation of its electric utility operation into independent generation and distribution entities. The company said such a move could result in a $35 million rate decrease.

PNM said the generation company would provide projected power needs of the distribution entity under a 30-year "power security agreement", which would have a pre-set rate structure to provide stabilization and predictability for electric rates.

In addition, the company hopes a restructuring would provide for PNM's gas and water utilities and its non-utility companies to become subsidiaries of the proposed holding company approved by PNM shareholders in May 1986.

### Rejected by commission

That proposal was rejected by the PSC last July, because the commission felt it wouldn't be able to examine the books of PNM's subsidiaries. According to a PNM spokesperson, a bill currently headed for passage by the New Mexico state legislature would grant the commission the right to examine all company records. The bill is supported by the utility.

The holding company would be the general partner of the limited partnership, thus said the company, the power distribution business would continue to be directed by PNM management.

The company first presented the limited partnership proposal to an ad hoc customer task force convened by the state governor. PNM's Robison

Continued on page 11

**EEI's highest honor**

## Three to vie for '87 Edison Medal

Robert A. Lincicome
Editor-in-Chief

WASHINGTON—Three electric utility companies will compete for the 1987 Edison Medal, the highest recognition given by the Edison Electric Institute. The three companies—Minnesota Power, Pacific Gas & Electric and Pennsylvania Power & Light—were nominated for the award by the Edison Award Review Committee, comprised of William Hayes, editor of *Electrical World*, Lucien Smartt, editor of *Public Utilities Fortnightly*, and chaired by this writer.

The three utilities were selected from a total of 10 companies that were recommended by regional nominators as "the electric companies whose achievements in 1986 constituted the most distinguished contributions to the growth and development of the electric light and power industry for the convenience of the public and the benefit of all."

The three utilities have been invited to prepare and submit formal presentations, from which the final winner will be determined. Presentation of the award will be made at the Institute's 55th annual convention in Cincinnati on June 10.

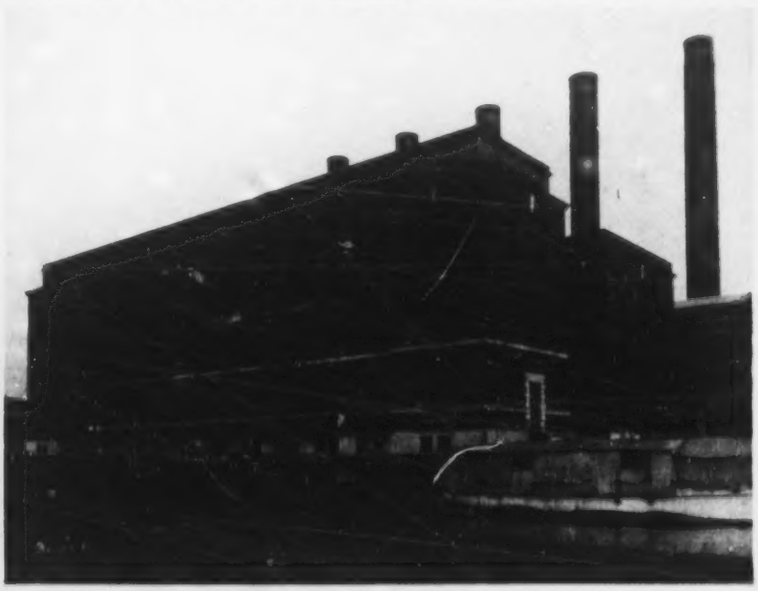
### Achievements described

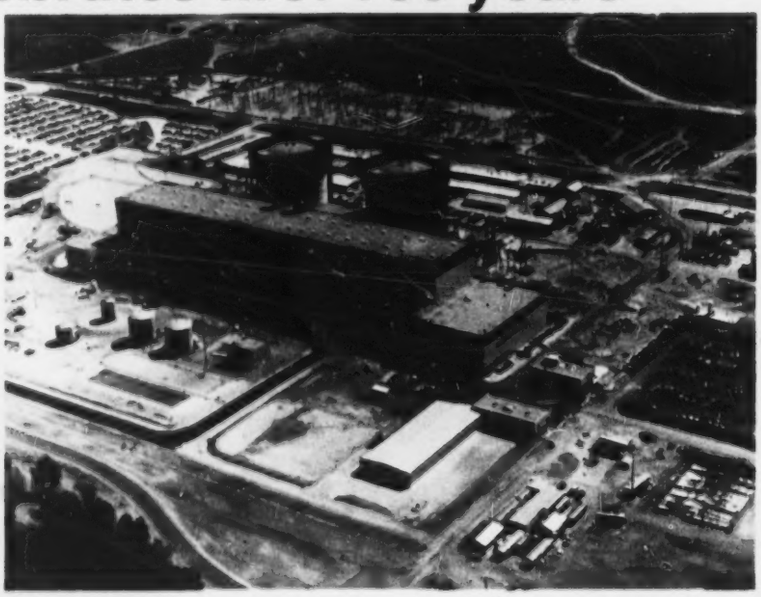
Minnesota Power, *EL&P's* Electric Utility of the Year last November, was nominated for its foresight and deep commitment to revitalization of its service area following the precipitous decline of its primary industrial base, taconite mining. The company has initiated a broad diversification program aimed at creating new jobs and improving the business climate of its service territory. This includes joint development of a $400-million papermill that will result in creation of some 4,000 jobs; a loan program to provide needed financing beyond conventional sources for startup, assistance or expansion; primary support of research aimed at improving the marketability of taconite; and other new and innovative programs aimed at improving the quality of life of its communities and customers. At the same time, the utility has maintained its rates at a level about 30 percent below the national average.

Pacific Gas & Electric was nominated for resisting a powerful effort to make space within its billing envelopes available to public groups for the dissemination of messages with which the utility disagreed. This effort culminated in the successful appeal to the U.S. Supreme Court, and that court's recognition of a utility's right under the First Amendment *not* to help spread a message with which it disagrees. The company also was cited for its leadership role in the coalition of utilities that obtained new

Continued on page 14

## Commonwealth Edison celebrates first 100 years





**********5-DIGIT 20814
4100127302 040187T 000000#
0000
SUITE 800 COPY # 1 80148
CONGRESSIONAL INFO SERVICES
4520 EAST WEST HWY
BETHESDA MD 20814

President Abraham Lincoln's son Robert Todd and 38 other investors founded the Chicago Edison Company one century ago this month in April 1887. A competitor named Commonwealth Electric Company soon came on the scene and in 1907 the two companies merged to form the Commonwealth Edison Company. This and other stories of the utility's first 100 years are chronicled in a new book of the company's history called "A Spirit Capable" written by Edison's John Hogan. Edison has come a long way since its first generating station, the Fisk plant (I.), was built in 1903. Today the utility has one of the largest nuclear power programs in the country. The company's Dresden station was the first commercial reactor built by an investor-owned utility. At right is the Braidwood station, Edison's newest nuclear plant.

# Environmental progress stalled, says FREE report

WASHINGTON—Wisconsin has the best set of environmental programs in the country, according to a new report from the Fund for Renewable Energy and the Environment (FREE).

The group's first State of the States report compares data on the various state energy and environmental protection programs. FREE noted an "overall stall" in progress for a safer environment.

"As the federal government retreated from its important role of protecting the environment, the states have been left to struggle with both new and existing environmental hazards," noted FREE Executive Director Tina Hobson. "And, because of economic conditions in most states, unless environmental threats are immediate and drastic, action has frequently been delayed, allowing public health dangers, long term environmental damage and an increase in cost for remedial action."

### State rankings

The report ranks the states in air pollution reduction, hazardous waste management, soil conservation, solid waste and recycling and renewable energy and conservation efforts. The top 15 rankings for combined achievement can be found in the accompanying table.

Following are the categories with the top states in parentheses: Air Pollution Reduction (California); Soil Conservation (Iowa); Solid Waste Disposal and Recycling (New Jersey); Hazardous Waste Clean-up (New Jersey); and, Groundwater Protection (New York).

Hobson said the report ranks the states by the relative strength of their legislation and programs. "Not surprisingly," noted the report, "some states with the worst problems have the best programs."

### Tough challenges

The executive director pointed out that states face tough challenges in balancing environmental responsibilities with other societal needs.

"But environmental issues appear to be gaining weight in that balance and we will be formulating a new 'Renew America' environmental agenda for the 100th Congress," stated Hobson.

### Cut backs

As to air pollution, FREE said funding for work in many states has been cut back and further progress may be restricted. The report says the real value of federal funding for air programs decreased 24 percent between 1979 and 1984.

**Combined Ranking of State Programs**

| Rank | State | Total Points (out of 60) |
|---|---|---|
| 1 | Wisconsin | 49 |
| 2 | California | 48 |
| 3 | New Jersey | 47 |
| 4 | Connecticut | 44 |
| 5 | Michigan | 43 |
| | New York | 43 |
| 7 | North Carolina | 42 |
| 8 | Florida | 41 |
| | Illinois | 41 |
| | Massachusetts | 41 |
| 11 | Iowa | 39 |
| 12 | Minnesota | 38 |
| 13 | Maine | 36 |
| | Indiana | 36 |
| 15 | Oregon | 35 |

*(Source: Fund for Renewable Energy & the Environment)*

FREE said, "As a result air monitors have been cut back by 29 percent of the states, only limited work is expected on acid rain, new toxic air pollution programs may not be initiated or fully implemented, and reduction targets for standard pollutants such as sulfur oxides, carbon monoxide, and ozone are not expected to be met."

### Air pollution records

The top ten states for air pollution reduction are California, Connecticut, New Jersey, Wisconsin, Michigan, North Carolina, Ohio, Pennsylvania, Virginia and West Virginia.

Support for development of renewable energy sources has been severely cut, noted the report. Federal research funding for renewable technologies has dropped from $771 million in 1981 to $176 million in 1986.

### Only ten states

"Coupled with this trend," noted FREE, "only ten states have implemented laws and authorities to press utilities for least-cost energy development and seven of the 24 states with solar and conservation tax credits have seen these provisions expire in the last two years."

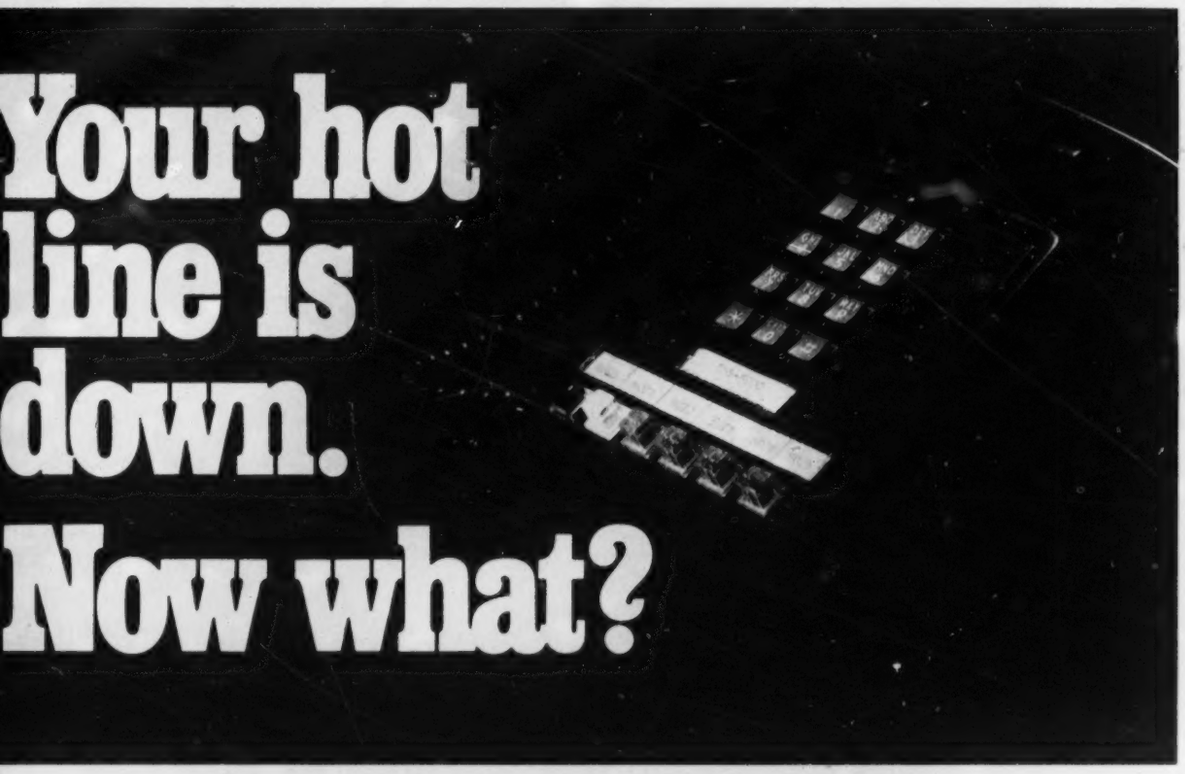
FREE said the six states with the best renewable energy and conservation policies are California, Wisconsin, Indiana, Maine, Massachusetts and Oregon.

### Reached a turning point

"I believe the stall in progress toward a safe environment has reached a turning point. Americans want their public health protected," said FREE Chairman Dennis Hayes. "We also have begun to realize that sustained economic growth is dependent on soil, water, air and other natural resources."

### More information

For more information on the report, contact FREE at (202) 466-6880.


Harris introduces reliable emergency communications for utilities.

Your backup communications system. You don't need it often, but when you do, it had better back you up.

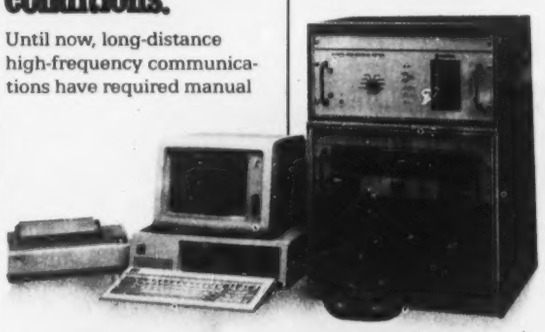
Now you can be sure in any emergency with reliable high-frequency, point-to-point communications from Harris that will back you up when all other lines are down.

**Introducing the Harris RF-7100 HF Adaptive Communications System.**

This cost-effective, user-friendly system requires only a single point-to-point HF radio link to communicate up to thousands of miles. Now when emergencies strike, you won't have to be concerned with telephone service breakdowns, satellite outages or VHF/UHF repeater failures.

**Instantly adapts to atmospheric conditions.**

Until now, long-distance high-frequency communications have required manual frequency selection. But the Harris Adaptive Communications System automatically selects the optimum transmission frequency to minimize atmospheric propagation problems and operator error.



HARRIS

**No special training necessary.**

Communicating from one station to another is as easy as making a phone call. By simply preprogramming channels, you can link up to any desired location within seconds—just by pushing a button. The system can be connected to a data modem for hard copy as well.

**Let Harris help.**

To find out how the Harris RF-7100 System can help you keep your lines open when all other lines are down, write Harris RF Communications Group, Civil/Industrial Marketing, 1680 University Avenue, Rochester, N.Y. 14610. Or call 1-800-4-HARRIS, ext. 3510.

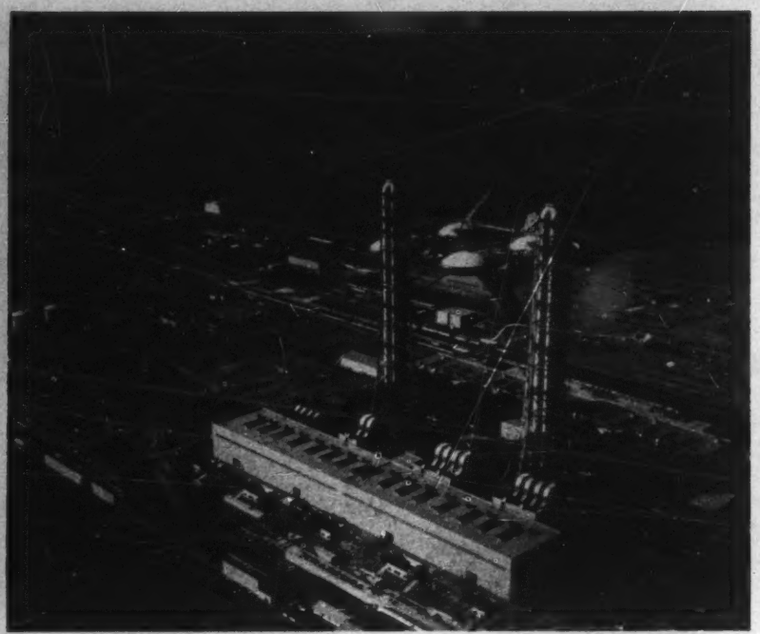
5/29/87 C6985-6

Volume 65, Number 5
May 1987

# Electric Light & Power

THE NEWS MAGAZINE OF ELECTRIC UTILITY MANAGEMENT AND TECHNOLOGY

A PENNWELL PUBLICATION



## Japanese start combined-cycle plant

Tokyo Electric Power Comany's first combined-cycle power plant, Futtsu Thermal Power Station, has gone into service. The seven-unit 1000-MW plant already has recorded a thermal efficiency of 43.8 percent. The plant is located on reclaimed land in Tokyo Bay and burns liquified natural gas. General Electric supplied the generating systems and associated equipment. An identical second 1000-MW combined-cycle station currently is under construction.

## U.S. in danger of dependence on imported oil, says report

WASHINGTON—U.S. oil imports will continue to increase beyond 1995 making America and other nations highly dependent on potentially insecure oil supplies, according to a new study of the nation's energy security.

Released by Energy Secretary John S. Herrington in March, the energy security report to President Reagan warns that the outlook for the world energy situation in the future holds both opportunities and risks.

Although today's energy supplies are abundant, the report points out that trends are emerging that raise serious c
most hal
sumptior
than 40 p

**Oil Impo**

DOE p
will rise from 5.2 million barrels per day in 1986 to between 8 and 10 million barrels a day in the 1990s. Currently, about two-thirds of the free world's reserves lie in Saudi Arabia, Kuwait, Iran, Iraq, and the United Arab Emirates. The report also pointed out that two-thirds of the 10 million barrels per day of unused oil production capacity is in the Persian Gulf region.

The energy report predicts that the region's share of the world oil market will rise from its current share of less than 25 percent to between 30 and 45 percent by 1995. OPEC countries are expected to account for between 45 and 60 percent of market share, near the percentage shares held by OPEC in the 1970's, forecast the report.

"Although dependence on insecure oil supplies is thus projected to grow," stated the report, "energy security depends in part on the ability of importing nations to respond to oil supply disruptions; and this is improving."

Oil price decontrol and development of the strategic oil reserves have helped to make the U.S. more adaptable to changing situations, said the report.

**Boost to world economy**

**********3-DIGIT 206
41001E7E99*060187T 0000009
0000
SUITE 800 COPY # 2 $0058
CONGRESSIONAL INFO SERVICES
4520 EAST WEST HWY
BETHESDA
MD 20814

s of oil and oth-
continue to be
le prices, this
the world econ-

use lead times are so long for the discovery and development of oil reserves in frontier areas, and for the construction of new coal or nuclear plants, that projects not yet underway cannot be counted on before 1995.

While oil imports continue rising, the Energy Department says conventional production of natural gas in the U.S. will likely diminish beyond 1995.

"If coal or nuclear generation capacity proves less attractive in the future because of regulatory, financial, or any other sort of costs," predicted DOE, "the world is likely to consume more oil, face higher oil prices, and become more dependent

Continued on page 8

## Reagan announces $2.5 billion commitment to fight acid rain

WASHINGTON—Secretary of Energy John S. Herrington announced March 23 that late in the year DOE will conduct an $850 million solicitation for innovative clean coal technologies.

The announcement came on the heels of President Reagan's pledge several days earlier to seek $2.5 billion over the next five years for demonstration of clean coal technologies.

Reagan said the new commitment would help ensure that the U.S. continues to work closely with the Canadians in addressing the effects of acid rain. The President explained that $500 million will be requested for fiscal years 1988 and 1989 to fund new emissions control projects.

"I will also encourage industry to invest an equal or greater amount over this period, and to stimulate development and deployment of innovative technologies for reduction of air pollution emissions," said the President in a prepared statement.

**Advisory panel will be formed**

Reagan also directed Herrington to establish an advisory panel made up of state government participants and the government of Canada to advise on the funding and selection of new projects. The panel could total as many as 25 members, and will be chaired by Under Secretary of Energy Joseph F. Salgado.

Finally, Reagan asked Vice President George Bush to have the Presidential Task Force on Regulatory Relief to identify opportunities for addressing environmental concerns under existing laws. The White House explained that the task force will examine incentives and disincentives to the deployment of new emissions control technologies and other cost-effective, innovative emission reduction measures. Their findings will be reported in six months.

**Reagan considers Canada pact**

During an April 6 meeting with Canadian Prime Minister Brian Mulroney, Reagan "agreed to consider" a proposal to develop an accord between the U.S. and Canada on emission reductions.

In response to a question at Reagan's last news conference in March on whether he has considered setting acid rain reduction standards, the President said, "Yes, let me say that we've not just been sitting here holding back or anything...We have found out that the further we've gone, the more complex the issue of the source of acid rain becomes. So what we've been trying to do is avoid going down some avenue that would disappoint us and we wouldn't really solve the problem, but we would have wasted our resources."

Secretary Herrington stated that Reagan's proposal will strengthen the common bonds of cooperation with Canada, and place the U.S in the forefront of a current worldwide to address the acid rain problem.

"We will fashion a program that, over the next five years, will entail multiple rounds of competition to elicit the best ideas from the creative minds of American industry," noted Herrington. "Each of the concepts to be demonstrated in this expanded clean coal program will be linked by a common characteristic—the capability to combine a high degree of environmental effectiveness with improved economic performance and plant reliability."

The current Clean Coal program involves almost $400 million in federal funds. DOE said the first two project awards have been made, with seven more to follow.

**Clean coal program**

To implement the expanded program, Herrington said the U.S. will credit $150 million in federal funding earmarked for the first round of clean coal projects. These funds represent the federal share of five of the nine first-round projects. In addition, another $350 million will be requested in FY 1988. DOE also will ask Congress for an advance appropriation of $500 million on FY 1989 funds.

This combined $850 million will be combined into a single solicitation to be released, pending Congressional approval, between October and December of 1987. DOE explained that

Continued on page 9

*In the wake of Peach Bottom's closing*

## Sleeping on the job common to most industrial shift work

Robert A. Lincicome
Editor in Chief

BARRINGTON, IL—Shift operators that fall asleep while on the job may pose a threat to the safe operation of a nuclear power station, but they are by no means unusual says a California specialist in sleep disorders and work/shift scheduling.

Richard M. Coleman, a Stanford, CA psychologist and member of the clinical faculty at the Stanford University School of Medicine, spoke to *EL&P* after the Nuclear Regulatory Commission in late March ordered Philadelphia Electric to shut down its Peach Bottom nuclear plant because operators were observed sleeping on the job.

Coleman says 56 percent of shiftworkers in a recent survey of seven industrial plants—including

Continued on page 16

# News Briefs

JILL MINNER, Assistant Editor

## Westinghouse to design reactor for protracted nuclear war

● According to a report March 30 in *The New York Times*, the U.S. Air Force is looking into the possibility of constructing several hundred small nuclear reactors to be used in a protracted nuclear war. The *Times* said the Department of Defense has asked for $5.5 million for the project in the fiscal year beginning in October. Westinghouse Electric Corporation has been chosen to submit a design for a 10 MW reactor. Officials quoted in the story say the units would be used to supply emergency power for computers, communication lines, weapon launching sites, and support equipment. The *Times* stated that those involved believe it will cost $20 billion and five years to complete the program.

## Niagara Mohawk adopts stronger alcohol-drug abuse policies

● Niagara Mohawk Power Corp. has strengthened its alcohol and drug abuse policies, according to the utility. "While there is no evidence of any widespread situations of this nature at Niagara Mohawk, it is a national societal illness and we do have a responsibility as members of that society to help stem this growing problem," explained Perry B. Woods, Jr., company vice president for employee relations. The company said it is adopting an employee alert to spot alcohol and drug abuses, and will screen all employees at nuclear sites who are required to undergo annual physicals. Employees with nuclear responsibility will be taken off the job pending investigation of any illegal drug-related occurrences, noted Woods. In addition, the policy calls for mandatory drug or alcohol screening for any Niagara Mohawk employees involved in on-the-job accidents causing injury or damage where human error appears to be a factor.

## NorLight fiber optic network is operational and carrying traffic

● NorLight President and CEO Jim Rice recently announced that the organization's fiber optic network is operational and carrying customer traffic. "We are particularly excited about the role fiber optics will play in the expanding use of digital video transmissions in our region and the country," stated Rice. NorLight, a partnership of subsidiaries of five electric utilities in Wisconsin and Minnesota, serves Chicago, Minneapolis, Milwaukee and other areas in Illinois and Wisconsin.

## U.S. oil use increases sharply; nuclear power sets record

● Preliminary statistics prepared by the U.S. Department of Energy found that the nation's electric utilities increased their consumption of oil by more than 36 percent last year, the largest single-year percentage since the 1973 Arab oil embargo. "Here we go again," said Atomic Industrial Forum President Carl Walske, "Oil imports are rising, and it appears that America is in serious danger of forgetting the oil price shocks of the 1970s. OPEC has conceded that nuclear energy world-wide contributed sharply to their recent woes. It would be a pity if we allowed them to gain an advantage over us once again." AIF also reported that in 1986, U.S. nuclear power plants produced a record 414 billion kWh, an increase of 8 percent over 1985.

## Vogtle 1 granted full power license by the NRC

● Unit 1 of Georgia Power Company's Vogtle electric generating plant has been issued a full power license by the Nuclear Regulatory Commission (NRC). Vogtle 1 was previously licensed to load fuel and conduct low power testing (see March *EL&P* p.2). The NRC said it approved the full-power license after successful completion of the low power testing.

# In This Issue


**Editorial** ..... 4

**Calendar** ..... 13

**Competition in the electric utility** industry will ultimately result in the consolidation of the industry through mergers, acquisitions and buyouts, according to a prominent Wall Street analyst. ..... 17

**Find out how a power plant** can evaluate its safety climate. ..... 22

**Leasing** has become an increasingly popular tool for utility fleet managers. 25

**Electronic monitoring** of fuel stored in underground storage tanks keeps fleet operating costs down through efficient fuel usage. ..... 25

**Work scheduling** in the utility garage maximizes shop space, mechanic time, and ensures vehicle availability. ..... 26

**New Products** ..... 30

**Readers' Service** ..... 31

**New Literature** ..... 36

**Personnel** ..... 40

**Management Methods** ..... 41

**Regulatory Review** ..... 42


EL&P readers whose responsibilities include both Generation and Transmission/Distribution receive both technology sections. Other readers receive the technology section that applies to their respective area of responsibility. The Generation edition is indicated by a single dot (•) in the upper right corner of page 1; the T/D edition carries two dots (••). All readers receive EL&P's industry news section.

## HEI subsidiary acquires two windfarms from Control Data

● Hawaiian Electric Industries' subsidiary Hawaiian Electric Renewable Systems, Inc. has agreed to purchase two existing windfarms from Control Data Corporation. "We have always believed that Hawaii is the perfect location for this form of alternate energy and that it has a future here," stated HEI President C. Dudley Pratt, Jr. The windfarms, located at Kahua Ranch and Lalamilo on the island of Hawaii, have a total generating capacity of 5,700 kW. "With the new technology that is now available to us, we believe we can operate these windfarms in an economically viable manner. We also expect to have the wind rights to expand at Kahua Ranch if it becomes economically feasible" added Pratt.

## FERC approves Western Systems Power Pool trial operation

● Operation of the Western Systems Power Pool (WSPP), an experimental system intended to reduce the power costs of 15 utilities, has been approved by the Federal Energy Regulatory Commission. Under a two-year plan, the marketplace—rather than regulatory bodies—will set prices for discretionary wholesale sales of electric energy and transmission between WSPP utilities in 10 western states. "We hope to begin operations as soon as possible because this power pool arrangement will help utilities and their customers save money on energy costs," said Louis Vicent, WSPP spokesman and Pacific Gas and Electric Co. attorney.

## APPA recognizes NY Power Authority for safety record

● The New York Power Authority was recently honored by the American Public Power Association for having the 'best safety record among the largest public power systems during 1986'. "This award reflects our commitment to safety," stated Power Authority Chairman Richard M. Flynn, "We're very proud that the APPA has honored that record." The awards were given to public power systems in seven categories at APPA's E&O workshop in Nashville.

## Atlantic Electric sends personalized letters to its customers

● Atlantic Electric said its residential and commercial customers will be receiving a personalized letter detailing how much energy they used in the past year, what it cost, and how their payments were applied to the company's expenses. Atlantic Electric said the purpose of the mailing, now in its fifth year, is to keep customers informed of their energy buying decisions. "We feel that the letter is a good vehicle for demonstrating the value of electricity," said Atlantic Electric Vice President Customer Service Meredith I. Harlacher, "It stresses the value of electricity and conservation by using each customer's own consumption figures. It's an annual report to each customer."

## Harvard honors Ginn as "Business Statesman of the Year"

● Centerior Energy Corp. Chairman and CEO Robert M. Ginn was named "Business Statesman of the Year" at the Harvard Business School Club of Cleveland's 29th Annual Business Statesmanship Award Dinner. The award is given annually to a Cleveland area CEO who "combines excellence in management of his business with civic involvement." In 1986, Ginn engineered the merger of Cleveland Electric Illuminating Co. and The Toledo Edison Co. to form Centerior Energy Corporation.

## Public power issued $21.4B worth of revenue bonds in 1986

● According to data published in the American Public Power Association's *Public Power* magazine, local publicly owned electric utilities issued $21.4 billion worth of electric revenue bonds last year, or 18.7 percent of all tax-exempt bonds sold in 1986. APPA said 22 public power joint action agencies accounted for 44.4 percent, or $9.5 billion, of the bonds issued, and Intermountain Power Agency issued the largest amount of bonds with $2.45 billion.

## TMI-1 resumes electricity production after five-month outage

● Three Mile Island Unit 1 has resumed electricity production after completing a five-month refueling and maintenance outage which began November 1, according to GPU Nuclear Corporation. The company said the outage, which followed a successful 13-month operating period, included extensive modifications to the plant's fire protection system. GPU has scheduled the unit's next refueling outage for the summer of 1988.

## PEPCo's Thompson chosen as one of top CEOs in nation

● Potomac Electric Power Co. Chairman of the Board and CEO W. Reid Thompson has been chosen as one of the nation's top 12 CEOs by *Financial World* magazine. The silver award winner was selected from among 2,400 executives of public companies with annual revenues exceeding $100 million. Thompson was cited for having "one of the best records for earnings and dividend growth in the industry," while managing to keep PEPCo's rates to consumers low, according to the utility. This marks Thompson's second silver award, he received his first in 1982.

## PG&E's Diablo-2 completes first year of commercial operation

● Pacific Gas and Electric Co. said Unit 2 of its Diablo Canyon nuclear plant completed its first year of commercial operation in March. "We are extremely proud of Unit 2's performance..." stated PG&E President George A. Maneatis.

# Utility capacity expansion needed soon, says report

WASHINGTON—Odds are better than even that there will be power shortages before the end of the century unless the utility industry substantially expands its capacity, according to a new study of U.S. electricity supply and demand.

The study was done for the Utility Data Institute, a not-for-profit clearinghouse for electric and gas utility data, by Applied Economic Energy Research Company (AER) of New York.

### Most likely scenario

"While peak load should not surpass installed capacity by the year 2000, it is expected to exceed available capacity by 1997," explained AER President Marie Corio emphasizing that there is usually a certain portion of installed capacity out of service. "The most likely scenario of demand growth and projected supply indicates a capacity shortfall of five percent by the year 2000. Nationwide the probability that utilities will be unable to meet peak load is 7 percent in 1992, rising to 25 percent in 1994 and 50 percent in 1977."

The study used data from UDI and from the North American Electric Reliability Council to forecast by region of the country peak load demand and installed capacity under a variety of assumptions. AER then evaluated the adequacy of electricity supply by calculating projected operating margins.

### Regional shortages

On a regional basis, UDI said the southeastern and the south central regions of the U.S. face the severest prospects of supply shortages. Based on current construction plans, both regions are likely to experience negative operating margins by 1993, six years from now. (See accompanying chart.)

Since new power plants require at least that length of time to plan and put into service, the report says these regions' options to avoid shortages are limited. Without additional capacity these regions are virtually certain to experience a supply shortfall by the year 2000, stated the report.

AER noted that the probability of shortages in the Midwest and Mid-Atlantic states by the end of the century is greater than 50 percent. While the risk of power shortages in New England, most of Texas and the West is less than 50 percent, but still significant.

### Group forecasts

The research group forecasts average national electricity demand growth of nearly 2.4 percent annually throughout the rest of this century, with regional growth rates varying from 1.8 percent in the Mid-Atlantic states to 3.1 percent in Texas. AER's forecast of electricity consumption in the year 2000 is 3.6 trillion kilowatthours. The amount of capacity required to meet that load will be 664,000 MW, about 44 percent more capacity than was required in 1985.

### Peak demand uncertain

According to the report, peak demand forecasts are subject to a large degree of uncertainty. There is a one-sixth probability that peak demand in the year 2000 will exceed 750,000 MW. Also, there is an equal probability that it could be as low as 577,000 MW.

PROBABILITY THAT ELECTRIC UTILITIES WILL BE UNABLE TO MEET PEAK DEMAND BY THE END OF THIS CENTURY

| Region | Probability that Operating Margin is Less than Zero in: 1990 (%) (1) | 1995 (%) (2) | 2000 (%) (3) |
|---|---|---|---|
| ECAR | — | 22.8% | 56.1% |
| ERCOT | 4.5% | 9.5% | 48.5% |
| MAAC | 1.4% | 38.1% | 62.6% |
| MAIN | 16.4% | 52.9% | 77.6% |
| MAPP | 2.3% | 54.6% | 80.1% |
| NPCC | 0.1% | 8.6% | 43.5% |
| SERC | 13.0% | 72.5% | 90.0% |
| SPP | 8.2% | 83.8% | 92.6% |
| WSCC | — | 7.3% | 43.7% |
| U.S. | 0.5% | 33.7% | 69.8% |

*Note: — designates less than 0.1%.*

*(Source: Utility Data Institute)*

### Source of uncertainty

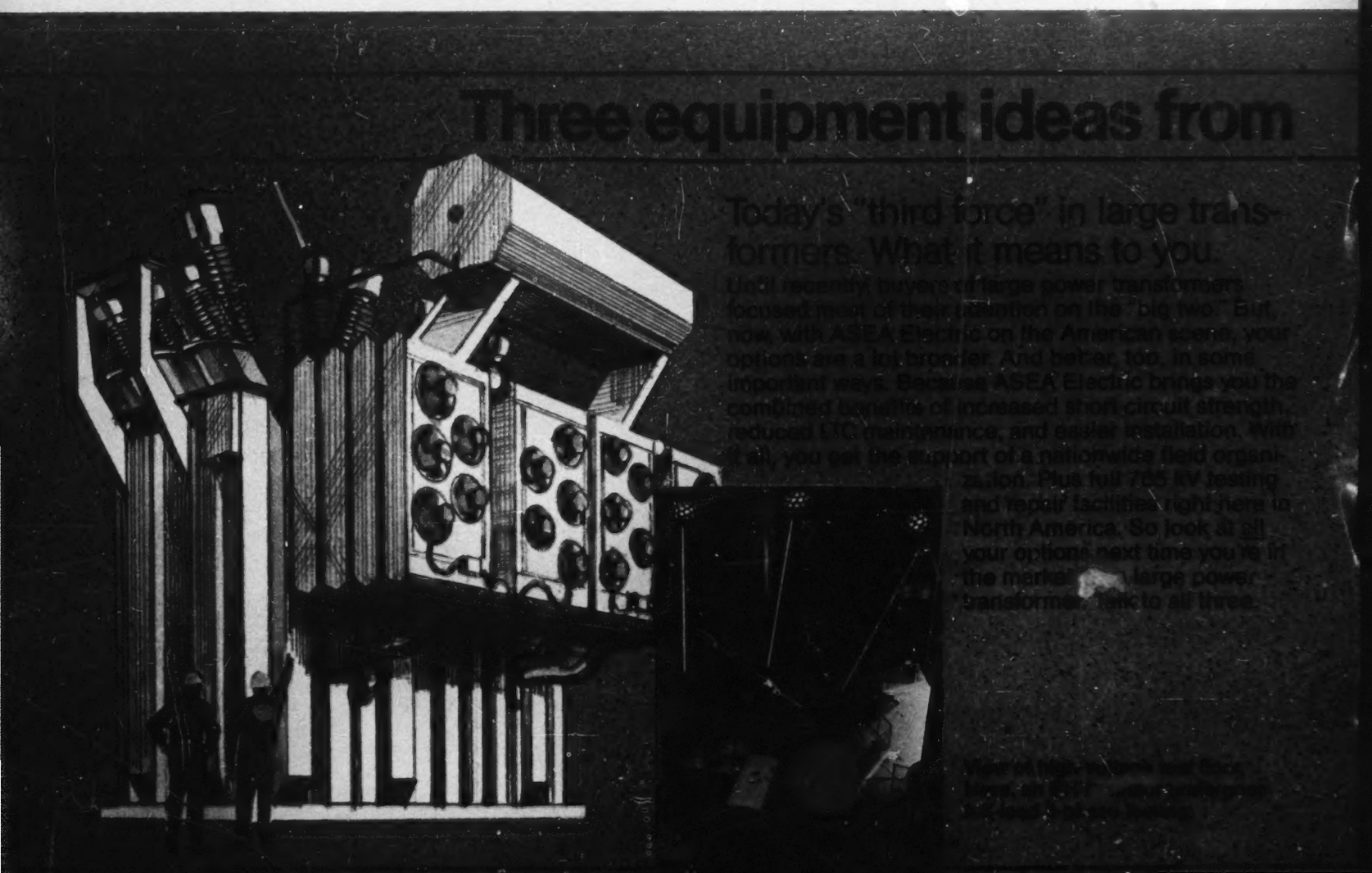
AER Vice President and co-author of the study Sandra Lazo said the major source of uncertainty about the electricity supply is the completion and operation of new generating capacity according to present schedules.

Depending on how closely current schedules are followed, she said installed capacity is expected to be in the range of 709,000 to 719,500 MW at the end of the century. However, because of unexpected outages or routine maintenance, about 14 percent of that capacity will not be available to serve the peak load.

The report concludes that given the imminence of inadequate operating margins, substantial shortages can be avoided only by planning now for increased capacity.

### Copies available

Copies of the 480 pp. report entitled *The Adequacy of U.S. Electricity Supply Through the Year 2000*, are available from UDI for $750. For more information call UDI at (202) 466-3660.

- C6985-6
6/17/87

Volume 65, Number 6
June 1987

# Electric Light & Power

THE NEWS MAGAZINE OF ELECTRIC UTILITY MANAGEMENT AND TECHNOLOGY

A PENNWELL PUBLICATION

# 1986 performances mixed for Top 100

Robert A. Lincicome
Editor-in-Chief

BARRINGTON, IL—Net incomes and earnings for common stock of the nation's Top 100 electric utility companies improved in 1986 on mixed individual performances. Collective kilowatthour sales, average residential use and numbers of customers eeked out small gains, but revenues declined. Overall, it was a mixed year for the industry.

Despite improving on 1985 performances, the results posted by the top 100 electric utilities in 1986 generally did not equal those of 1984, which was a banner year for the industry...

This is the overall picture painted by *EL&P's* 22nd Annual Top 100 Electric Utilities Survey, conducted earlier this year.

**Income up on reduced revenues**

Net incomes, which fell substantially in 1985, rebounded in 1986 to $17.3-billion. This represents a gain of 11.8 percent from the 1985 total of $15.5-billion.

And earnings per share of common stock, which were $2.64 in 1985, increased 6.1 percent, to $2.8 per share in 1986. This figure, which represents the average earnings per share for the 99 companies reporting financial data, reflects restated earnings for 1985 and not just 1985 data as reported in last year's Top 100 survey.

**The 22nd Annual Top 100 Electric Utilities report begins on page 13**

The fact that net incomes rose solidly is especially noteworthy in light of the decrease in revenues. Revenues posted by the Top 100 slid 0.53 percent to $149.3 billion from $150.1 billion a year earlier. The revenue decline reflects rate reductions and lower fuel adjustment collections since kWh sales were actually up slightly in 1986.

Income increases resulted from reduced fuel costs, lower interest payments as older high interest-bearing bonds have been refunded and as construction costs have been slashed, and from continuing cost-control efforts by utility managements.

**Customers, kWh sales grew**

Customer growth for the Top 100 electric utilities was 1.96 percent, which coupled with kWh sales growth of just 1.14 percent and average residential usage growth of 1.12 percent, illustrates the seriousness of reductions in industrial use of electricity.

Customers increased from 76.4-million in 1985 to 77.9-million last year. This increase was less than reported a year ago, when customer growth was 2.6 percent.

Total kWh sales, for all purposes, were 2.0-trillion kwh, marginally ahead of the 1.98-trillion kWh reported a year ago.

Average residential use also was ahead marginally, from 8538 kWh in 1985 to 8634 kWh last year.

## Legislators call for Roberts to resign because of document leak to utility

WASHINGTON—Sen. John Glenn (D.OH) and several congressmen are calling for the resignation of Commissioner Thomas Roberts of the Nuclear Regulatory Commission.

Roberts, a two-term commissioner, is alleged to have had improper contact with a Louisiana electric utility. In addition, his testimony given before a recent Senate Governmental Affairs hearing has been questioned by the lawmakers.

"This testimony concerned Commissioner Roberts' inadequate and inappropriate handling of leaked NRC documents from his office to a licensee regulated by the utility," said Glenn in a prepared statement. "After reviewing the entire record of this matter, I am convinced that the NRC and the public it serves cannot afford to retain Commissioner Roberts, who clearly demonstrated poor judgment and self-serving behavior."

The allegations center around NRC documents relating to quality assurance problems at Louisiana Power & Light Company's Waterford plant that were leaked in April 1983 to the utility from Roberts' office.

Glenn stated that when the leak was accidentally discovered in 1985, Roberts conducted an internal investigation into the leak instead of referring the matter to the NRC Office of Inspector and Audit (OIA).

Roberts admitted at the April hearing that he had then asked for all NRC copies of the document, and had them destroyed.

"After careful reflection of the entire record," said Glenn, "I am now convinced that Mr. Roberts' deliberate destruction of the incriminating evidence requires his resignation. Mr. Roberts' actions and explanations call into question his objectivity and leadership abilities."

*At press time, Commissioner Roberts announced he was taking a brief leave of absence from the NRC to prepare testimony before the Senate Environment and Public Works Subcommittee on Nuclear Regulation, which is investigating the allegations made against Roberts. Five separate bodies are conducting investigations into the allegations. In addition to the Senate subcommittee, they include the Washington U.S. Attorney, the House Interior Committee, the Senate Governmental Affairs Committee, and an NRC internal investigation that is being turned over to an outside counsel.*

Glenn sent the matter on to the U.S. Justice Deparment, which announced it was assigning the case to the U.S. District Attorney in Washington.

After the Justice Dept. became involved in the matter, Roberts announced that he had found copies of the missing documents.

The Justice Dept. is continuing its investigation of the matter, having taken over the investigation from the NRC's OIA.

Roberts, in a statement, said he was "truly shocked" by Glenn's request. "I

Continued on page 7

**********5-DIGIT 20814
41001273 11*0601 87T 0000000
JOSEPH MCNALLY 0000
80149
CONGRESSIONAL INFO SERVICES
4520 EAST WEST HWY
BETHESDA MD 20814

## Superconductivity R&D moves on

Advances in superconductivity research are proceeding at a quickened pace. Here, a coil of superconducting material at AT&T Bell Laboratories registers zero resistivity in a beaker of liquid nitrogen. Recently at Bell and other labs around the world, superconductors were discovered that only need to be cooled to about 95 degrees Kelvin. Previously, superconductors needed to be cooled to approximately 23 degrees Kelvin (-419 degrees Fahrenheit). At AT&T, researchers are exploring whether a new theory of superconductivity is needed. Also, one AT&T scientist reports that his team has devised ways to process one of the new materials into thin tapes and toroids that don't lose their superconductivity above 90 degrees K. Another researcher says Bell Labs has developed superconducting wires that can easily be formed into coils.

## Power generating costs from central stations rising, says UDI

WASHINGTON—Annual electricity generating costs for central station power plants in the U.S. are on the rise, according to a new report from the Utility Data Institute.

Between 1981 and 1985, the study shows that nuclear plants experienced the greatest percentage increase in operating costs—56 percent per net MWhr produced. This is up from $11.95 per net MWhr in 1981 to $18.67 per net MWhr in 1985. The analysis was based on 45 nuclear plants that operated all five years. Newer units entering service since 1981 are not included in the report.

Coal plants (295 sampled) showed a 10 percent per net MWhr increase, from $20.60 per net MWhr in 1981 to $22.60 per net MWhr in 1985.

Gas-fired power plant expenses rose 24 percent (from $34.07 in 1981 to $42.33 in 1985), while oil-fired plant expenses dropped from $55.08 in 1981 to $52.82 in 1985.

The UDI report, *U.S. Steam Electric Plants: Five Year Production Costs 1981-1985*, analyzes five years of operating, maintenance and fuel expenses for 500 steam-electric plants located throughout the nation.

Based on variable operating, maintenance and fuel expenses reported annually by electric utilities to agencies of the Federal government, the report provides a detailed accounting for each of the sampled plants for each year of data.

Then, said UDI, an "average plant cost" based on all five years is calculated for each plant.

Based on the five year average indicator, UDI ranked the top 100 plants

Continued on page 3

# UK to build its first pressurized water reactor plant

LONDON, UK—The United Kingdom will build its first pressurized water reactor power plant at Sizewell, near Suffolk, on the southeast coast. The decision came after a two-year inquiry and another two years of study and analysis of some 55 tons of testimony and documentation leading to the final report approved by Parliament.

More than 90 percent of the equipment will be manufactured and fabricated in the U.K. Westinghouse will design and erect the primary reactor coolant system, manufacture some components and will transfer extensive technology for the 1150-MW plant. Westinghouse previously had been awarded contracts from the Central Electricity Generating Board for the Sizewell plant, contingent upon a favorable outcome to the public inquiry. CEGB is the British national electric utility.

Westinghouse's technology for the design of the PWR system will be transferred through its licensee in the U.K., the National Nuclear Corp.

### More to come

Lord Walter Marshall, chairman of the CEGB, said the utility will apply for planning consent for a second PWR to go at the Hinkley power plant site in Somerset. The application will be made sometime this year, he said. A PWR at Hinkley would be the third nuclear unit at the site. The other two are gas-cooled reactors.

Marshall explained that the CEGB would like to build up to five PWRs before the end of the century.

### Significant decision

Ted Stern, Westinghouse executive vice president for energy systems, called the British decision "significant" to the nuclear industry. "No decision on a new power plant in my memory has been made with so much care and following such a thorough investigation, he added. "The conclusion that the Westinghouse pressurized reactor is safe and the most economical source of electricity for the United Kingdom was one which we had anticipated, given the thoroughness of the inquiry, he concluded."

# *AP&L CEO Maulden launches new environmental effort*

Jerry L. Maulden, Arkansas Power & Light Co. president and CEO, grabs a rake to help members of a local Future Farmers of America chapter plant a wildlife food and cover plot on an AP&L 500,000 volt transmission line right-of-way through a portion of Pinnacle Mountain State Park near Little Rock, Ark. AP&L and the Arkansas Wildlife Federation are co-sponsoring the "Rights-of-way for Wildlife" program, which has been designed to encourage the planting of wildlife food on plots situated on more than 4,800 miles of transmission rights-of-way.

# Control design service offered

SCHENACTADY, NY—A new design service for coordinating controls within a large-scale power system has been announced by General Electric.

The service will address the need for coordinating numerous controls within an interconnected power system to avoid degrading system security. As systems are expanded or upgraded, the number of significant controllable elements increases, as does the potential for adverse control interaction. While individual subsystems are designed with internal controls and may represent the products of a single manufacturer, overall system security is dependent on a higher-level control function that integrates a variety of components from a number of different suppliers.

According to GE, the new service will draw on the company's systems expertise and knowledge of controlled devices to offer utilities analytical studies, field testing services and specification of high-level control equipment.

GE says its capabilities to perform studies range from analysis of selected applications to extensive simulations of large-scale systems.

On the application level, the company says it can determine operating parameters and limitations imposed on control responses, including those caused by subsynchronous interactions with transmission and generating equipment.

Field tests conducted in the early stages of system design can verify analytical models. If conducted in the latter stages of implementation, GE says, field tests can be used to verify critical performance aspects.

# Power generating costs from central stations rising . . . from page 1

on the basis of efficiency. In terms of economic efficiency, nuclear plants continued to be the most cost-effective. UDI points out that 16 of the top 20 plants were nuclear (See table.) The other four members of the top 20 include two gas-fired and two coal-fired plants, all located in Texas.

### Top five

The top five most cost-effective plants in descending order are West Texas Utilities' Rio Pecos, Gulf States Utilities' Sabine, Northern States Power Company's Prairie Island, Virginia Electric & Power Company's North Anna, Florida Power & Light Company's Turkey Point 3 & 4, and Commonwealth Edison Company's Zion station.

UDI said the top 100 most efficient plants included 27 nuclear, 69 coal-fired and four gas-fired plants.

### Total generation

Plants were also ranked in terms of total generation. Three coal-fired plants exceeded 90 million net megawatthours during the five year period. They included Georgia Power Company's Bowen, Detroit Edison's Monroe, and Houston Lighting & Power Company's W.A. Parish. Duke Power Company's Oconee nuclear plant ranked fourth, with more than 78 million net MWh generated.

The top 100 plants on the basis of total generation include 69 coal-fired, 21 nuclear, seven gas-fired and three oil-fired plants.

UDI is a not-for-profit clearinghouse for utility data and information. The new 610-page study is available from UDI at a cost of $395 per copy ($320 for electric utilities).

Table 1
Top 15 U.S. Steam Electric Plants Ranked by Total Generation (Net MWHrs) 1981-1985

| Rank | 1981-1985 Total Generation (Net MWhrs) | Plant Name | Fuel | Gross Capacity (MW) | Operator | 1st Unit Year | Last Unit Year | NERC Region | State |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 92639882 | Bowen | Coal | 3499 | Georgia Power Co. | 1971 | 1975 | SERC | GA |
| 2 | 92156276 | Monroe (MI) | Coal | 3280 | Detroit Edison Co. | 1971 | 1974 | ECAR | MI |
| 3 | 91788221 | WA Parish | Coal | 3953 | Houston Lighting & Power | 1958 | 1982 | ERCOT | TX |
| 4 | 78240197 | Oconee | Ur | 2667 | Duke Power Co. | 1973 | 1974 | SERC | SC |
| 5 | 74387878 | Amos | Coal | 2933 | Appalachian Power Co. | 1971 | 1973 | ECAR | WV |
| 6 | 73086773 | Gibson | Coal | 3340 | Public Service Indiana | 1975 | 1982 | ECAR | IN |
| 7 | 69195472 | Roxboro | Coal | 2558 | Carolina Power & Light Co. | 1966 | 1980 | SERC | NC |
| 8 | 68631146 | Browns Ferry | Ur | 3456 | Tennessee Valley Auth. | 1974 | 1977 | SERC | AL |
| 9 | 66963627 | JM Stuart | Coal | 2441 | Dayton Power & Light Co. | 1970 | 1974 | ECAR | OH |
| 10 | 66389558 | Martin Lake | Coal | 2380 | Texas Utilities Elec. Co. | 1977 | 1979 | ERCOT | TX |
| 11 | 64298516 | Belews Creek | Coal | 2160 | Duke Power Co. | 1974 | 1975 | SERC | NC |
| 12 | 63018854 | Four Corners | Coal | 2271 | Arizona Public Service Co. | 1963 | 1970 | WSCC | NM |
| 13 | 61447891 | Monticello (TX) | Coal | 1980 | Texas Utilities Elec. Co. | 1974 | 1978 | ERCOT | TX |
| 14 | 61376510 | Bruce Mansfield | Coal | 2805 | Pennsylvania Power Co. | 1976 | 1980 | ECAR | PA |
| 15 | 59226801 | Labadie | Coal | 2412 | Union Electric Co. | 1970 | 1973 | MAIN | MO |

Table 2
Top 15 U.S. Steam Electric Plants Ranked by Five-Year Average Cost Per Net Megawatt Hour

| Rank | 5-Yr. Avg. ($/Net MWhr) | Plant Name | Fuel | Gross Capacity (MW) | 1981-1985 Generation (Net MWHrs) | Operator | 1st Unit Year | Last Unit Year | NERC Region | State |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.11 | Rio Pecos | Gas | 142 | 5004672 | West Texas Utilities Co | 1959 | 1969 | ERCOT | TX |
| 2 | 8.61 | Sabine | Gas | 2051 | 49342477 | Gulf States Utilities Co. | 1962 | 1979 | SPP | TX |
| 3 | 9.86 | Prairie Island | Ur | 1186 | 37661266 | Northern States Power Co. | 1973 | 1974 | MAPP | MN |
| 4 | 10.04 | North Anna | Ur | 1959 | 48963148 | Virginia Elec. & Power Co. | 1978 | 1980 | SERC | VA |
| 5 | 10.52 | Turkey Point 3&4 | Ur | 1520 | 36741544 | Florida Power & Light Co. | 1972 | 1973 | SERC | FL |
| 6 | 10.63 | Zion | Ur | 2196 | 53092931 | Commonwealth Edison Co. | 1973 | 1974 | MAIN | IL |
| 7 | 10.83 | Big Brown | Coal | 1187 | 35999939 | Texas Utilities Elec. Co. | 1971 | 1972 | ERCOT | TX |
| 8 | 11.17 | Calvert Cliffs | Ur | 1828 | 55121095 | Baltimore Gas & Elec. Co | 1975 | 1977 | MAAC | MD |
| 9 | 11.84 | Quad Cities | Ur | 1657 | 45699316 | Commonwealth Edison Co. | 1973 | 1973 | MAIN | IL |
| 10 | 11.89 | Oconee | Ur | 2667 | 78240197 | Duke Power Co. | 1973 | 1974 | SERC | SC |
| 11 | 11.83 | Surry | Ur | 1695 | 44340599 | Virginia Elec. & Power Co. | 1972 | 1973 | SERC | VA |
| 12 | 11.93 | DC Cook | Ur | 2285 | 58528109 | Indiana & Mich. Elec. Co. | 1975 | 1978 | ECAR | MI |
| 13 | 12.18 | Maine Yankee | Ur | 864 | 25954951 | Maine Yankee Atomic Power | 1972 | 1972 | NPCC | ME |
| 14 | 12.27 | Sequoyah | Ur | 2441 | 50606546 | Tennessee Valley Auth. | 1981 | 1982 | SERC | TN |
| 15 | 12.30 | Dresden | Ur | 1657 | 39128231 | Commonwealth Edison Co. | 1970 | 1971 | MAIN | IL |

*(Source: Utility Data Institute, Inc.)*

# Editorial

## Cogen, open transmission and deregulation go together

Structural changes in the electric power industry have only begun. As a result of the Public Utility Regulatory Act of 1978 (PURPA) and the continuing trend toward greater deregulation, the time is fast approaching when electric utility companies will have to decide whether they will earn the right to serve because they offer the best source of reliable, economic energy or whether they will retreat behind the bastion of regulatory protection to weather the threat.

The recent Federal Energy Regulatory Commission hearings on PURPA, the last of four, provided a broad range of views on standards for qualifying cogeneration and small power producer facilities, pricing of power from those facilities, and their dependence on access to utility transmission. While most of the testimony tended to support proprietary interests, we were impressed by the presentation of Virginia Power's chairman, William W. Berry, who combined non-utility power production, transmission access and open competition into a single set of recommendations.

Berry's proposals might serve as a basic blueprint for building the energy company of tomorrow...a utility working and thriving in an open energy market. He proposed a free market for new electric generation that would award capacity payments to only the most efficient projects so that incremental capacity always would be obtained at the least cost. His plan would call for utilities to develop their own estimates of supply and demand and a schedule of when new capacity would be needed. Prospective non-utility generators would bid for whatever portion of added capacity they desire on the basis of capacity price and incremental operating costs and the bids would be evaluated according to a specified set of criteria.

He proposed that potential generators be guaranteed access to transmission so they could reach sufficient potential buyers to create workable competition and "eliminate utility monopsony" (where the services of a number of sellers is sought by only one buyer). For utilities to obtain their capacity at free market prices, he said, they must volunteer to provide transmission services so that suppliers within their control area can also bid on the capacity of other utilities. "With competition permitted by the availability of transmission services to non-utility generators, market pricing would be efficient and fair to generators, to the utilities and to the public," he concluded.

Berry's program reflects no siege mentality, but rather one that seeks open, free competition. It merits the thought, and support, of the whole industry.


**Don't Miss It!**

**ELECTRIC MARKETS '87**

A one day conference probing the relationship between independent, unregulated power producers and the regulated electric power industry from now until the end of the century. Discussions will include the changing marketplace and its effect on possible deregulation of the electric power industry ...from generating plant to the customer.

Thursday, July 9, 1987
8:30 a.m. to 4: p.m.
Marriott O'Hare Hotel
Chicago, Illinois

Sponsored by *Power Engineering*

For information, call Robert Mattis, Conference Management, Inc., (312) 887-1699


# *Increased electric utility R&D can help lower power prices*

WASHINGTON—More investment in national electric utility research and development programs will help to reduce future electricity costs, says Dr. Chauncey Starr.

The Electric Power Research Institute President Emeritus said that electrification, technical progress, and productivity growth are interwoven. Starr stated that low cost electricity would be an important stimulant to global economic growth.

At the recent Energy Technology Conference here, he said the U.S. electric utility industry has developed a centralized R&D program to reduce power costs, and to meet the new challenges of environmental and productivity goals.

Starr pointed out that the real price of electricity dropped by a factor of approximately five from 1930 to 1979. However, in the last 15 years, electricity prices almost doubled and now appear stable.

### Major accomplishments

The accompanying table shows a few of the major technical accomplishments and utility performance changes during the last 55 years. Starr explained that the major technical improvement was the increase in thermal efficiency.

In the 1970s prices began to rise. Starr said the oil price shocks of 1973 and 1979; a decline in plant thermal efficiency; high real interest rates; and, increasing regulatory delays all helped to aggravate the situation. He told the conference attendees that real capital costs for central station power plants between 1960 and 1980 rose by a factor of four.

EPRI's President Emeritus said the industry's near-term R&D program focuses on modification and life extension of existing equipment. Intermediate and long-term objectives include substantially reducing the cost of supplying electricity, mitigating the constraints associated with resource and environmental problems, and developing new uses of electricity to help increase the productivity of American industry.

### R&D focus areas

Eight broad R&D areas were identified by Starr. They include: fuel flexibility, capital cost, reliability and availability, system efficiency, load management, environmental protection, energy storage, and end use productive efficiency.

EPRI recently launched the Benefits Assessment Program. Starr explained that a representative group of 24 utilities were asked to estimate the continuous annual savings resulting from their application of EPRI-developed technologies.

In 1985 the annual savings for just these 24 utilities using EPRI products was estimated to be $392 million compared with the EPRI annual funding of $334 million.

Continued on page 1

**HISTORICAL TECHNICAL ACCOMPLISHMENTS IN ELECTRICITY SUPPLY**

| | U.S. Electricity Price (¢/kWh sold in 1984$) | | | Technical Accomplishments Between 1929 and 1970 | Utility Performance Changes Between 1970 and 1984 |
|---|---|---|---|---|---|
| | 1929 | 1970 | 1984 | | |
| Fuel | 5.3 | 0.9 | 1.9 | • System heat rate reduced from 20,550 Btu/kWh to 10,510 Btu/kWh through equipment improvements<br>• Coal cost reduced from $45/ton to $17/ton (1984 $) through scale economy in coal production | • System heat rate increased to 10,540 Btu/kWh due to environmental control<br>• Coal cost increased to $35/ton (1984 $) due to general energy price increase |
| Generation | 5.6 | 1.4 | 2.2 | • New kW cost reduced by a factor of 2.5 through economies of scale<br>• System capacity utilization increased from 35% to 51% through availability improvements and system interconnection | • New kW cost doubled due to environmental control and construction delays<br>• System capacity utilization decreased to 41% due to load growth slowdown |
| Delivery | 6.9 | 1.7 | 2.1 | • New kVA cost reduced by a factor of 2.5 through voltage increase and economies of scale | • New kVA cost stabilized and system utilization decreased due to load growth slowdown |
| System | 17.8 | 4.0 | 6.2 | • System loss reduced from 18% to 9% | • System loss reduced to 7% |

*Sources: Electricity prices, fuel and technical data from EEI Statistical Yearbooks, 1925-1984; generation and delivery components based on income statements of investor-owned utilities.*


# Electric Light & Power

**EL&P. Staff**

**Publisher**
Robert J. (Duke) Kiesel

**Sales Manager**
Arthur L. Rice

**Editor-in-Chief**
Robert A. Lincicome

**Editorial Staff**
Donald F. Minner, Jr., Associate Editor
Henry Stein, Engineering Editor
Jill F. Minner, Assistant Editor
Dianne Wilson, Editorial Assistant

John Papamarcos, Consulting Editor
William Kenworthy, Legal/Regulatory Editor
Ted Pollock, Management Editor
Roberta C. Olmstead, Production Manager

PennWell PUBLISHING COMPANY

ELECTRIC LIGHT & POWER (USPS 858-880) is published monthly by the PennWell Publishing Company, 1421 S. Sheridan Road, Tulsa, OK 74112. © copyright 1987 by PennWell Publishing Company. All rights reserved. Officers of PennWell Publishing Company are: P.C. Lauinger, Chairman; Philip C. Lauinger, Jr. President; Joseph A. Wolking, Executive Vice President; Joseph T. Bessette, Group Vice President; John Maney, Vice President/Finance. Electric Light & Power editorial offices are located at 1250 S. Grove Avenue, Barrington, IL 60010. Phone (312) 382-2450. Distributed to executives and engineers in U.S. electric utilities and consulting engineering firms. Second class postage paid at Tulsa, OK. Subscription: $38 per year (U.S.), $46 (Canada), $66 (foreign); $108 (foreign air mail). Single issue price: $4 + postage ($5 + postage Canada, and $7 + postage foreign). Copies of back issues are available on microfilm from Univ. Microfilm, 300 N. Zeeb Road, Ann Arbor, MI 48106, and on microfiche from Micro-Photo Div. of Bell & Howell, Old Mansfield Road, Wooster, OH 44691. Postmaster: Send address change to ELECTRIC LIGHT & POWER, P.O. Box 2680, Tulsa, OK 74101.

Member ABC Audit Bureau of Circulations

ABP VBPA



Advertiser and advertising agency assume liability for all contents (including text representation and illustrations) of advertisements printed, and also assume responsibility for any claims arising therefrom made against the publisher. It is the advertiser's or agency's responsibility to obtain appropriate releases on any items or individuals pictured in the advertisement.

# Electric rates drop sharply, according to new survey

NEW YORK—Industrial and commercial electric rates charged by the 24 largest U.S. electric utilities have fallen by twice the national rate of inflation. A survey by National Utility Service, Inc., indicates that these utilities' rates have decreased by 4.3 percent while inflation increased at a 2.1 percent rate.

**U.S. Electric Rates 1987 vs. 1986**

| Company | 1987 rate ¢/kWh | 1986 rate ¢/kWh |
|---|---|---|
| American Electric Power | 4.77 | 4.71 |
| Carolina Power & Light | 5.39 | 5.60 |
| Central & South West | 4.25 | 4.51 |
| Commonwealth Edison | 6.93 | 7.04 |
| Consolidated Edison | 10.22 | 11.34 |
| Consumers Power | 6.06 | 6.06 |
| Detroit Edison | 6.76 | 7.01 |
| Duke Power | 5.36 | 5.10 |
| Florida Power & Light | 5.47 | 6.22 |
| General Pub. Utils. | 7.06 | 8.16 |
| Georgia Power | 5.01 | 5.08 |
| Houston Ltg. & Pwr. | 4.77 | 5.10 |
| Long Island Ltg. | 9.58 | 9.93 |
| Louisiana P&L | 5.26 | 5.13 |
| Niagara Mohawk Pwr. | 6.71 | 6.30 |
| Ohio Edison | 6.35 | 6.27 |
| Pacific Gas & Electric | 7.22 | 9.27 |
| Pennsylvania Pwr & Lt. | 6.29 | 6.45 |
| Philadelphia Electric | 7.22 | 7.38 |
| Public Service E&G | 7.10 | 8.29 |
| Southern Cal. Edison | 8,79 | 8.51 |
| Texas Utilities | 4.24 | 4.54 |
| Virginia Power | 4.36 | 4.47 |
| Union Electric | 5.72 | 5.15 |

(Average decrease — 4.3 Percent)

### Average rate charged

The average rate charged industrial and commercial customers fell to 6.29 cents per kWh in the period from April 1986 to April 1987. The April 1986 level was 6.59 cents per kWh.

Marvin Lauterbach, executive vice president of the company, said that most reductions have resulted from a restructuring of tariffs and the decrease in generating fuel costs. "Some customers have been fortunate enough to enjoy reductions of up to 22 percent as a result," he added. "The dramatic fall in oil prices, which took place last year, is still affecting the cost of electricity worldwide. The full impact of the reduced oil price is now being felt by electricity consumers, and it is likely that price movements over the next 12 months will generally follow that of oil."

### Worldwide price stability

The NUS survey of international electricity costs shows that prices have either fallen or remained stable in most major industrial nations. Belgium, Canada, France, Italy, Netherlands, Sweden, the United Kingdom and the USA enjoyed price declines, while Australia and West German prices remained stable. Future price rises, according to NUS, should be in line with, or below, rates of domestic inflation.

### Fifth most expensive

The U.S. remained the fifth most expensive nation for electricity, behind West Germany, Eire, Belgium and Italy.

The survey uses data drawn from prices paid by NUS clients at more than 750,000 business locations worldwide.

## EPRI previews video

CHARLOTTE, NC—The EPRI Maintenance Equipment Application Center has produced an 11-minute preview videotape that outlines the organization's three-part training videotape, "Pressure Boundary Bolting Problems". As described in the preview tape, the three parts of the main tape are: Part I—The Basics; Part II—Engineering Considerations; and Part III—The Mechanic and Bolting. Requests for the preview tape may be sent to: Susan Evans, EPRI Maintenance Equipment Application Center, P.O. Box 217097, Charlotte, NC 28221.

## Document leak . . .

from page 1

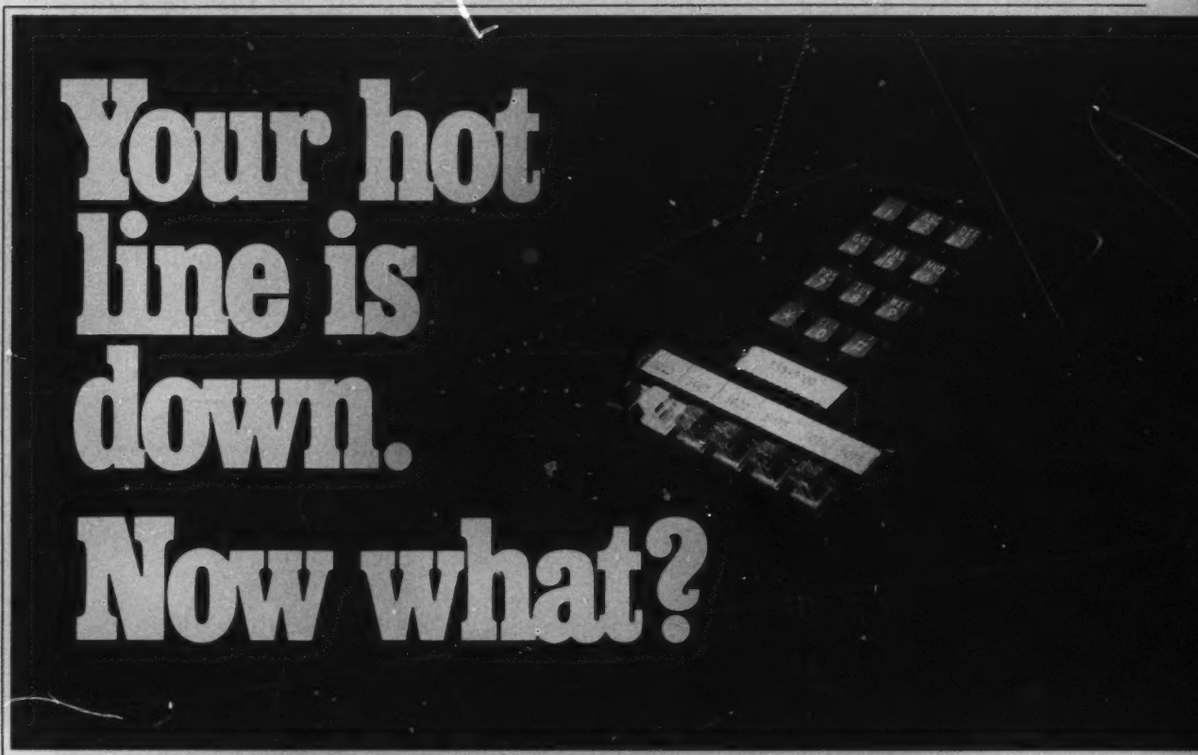
have done no wrong, and I have no intention of resigning," he said. "I welcome a review of these matters by the Department of Justice."

Five congressmen also have called for Robert's resignation, and asked that a special prosecutor be appointed to examine the NRC's integrity. The congressmen were John Dingell (D.MI), Philip Sharp (D.IN), Edward Markey (D.MA), George Miller (D.CA), and Sam Gejdenson (D.CT).

NRC Chairman Lando W. Zech said in a statement that the commission is moving "aggressively" to probe the allegations against Roberts and the NRC's investigative and regulatory processes.

Zech stated that "while we are prejudging no person and no component of this agency, we want to make clear that we will take whatever corrective action may be required to put our house in order."

He said the commission has initiated reviews of current policies and procedures for handling allegations involving commissioners and their offices; of the effectiveness of the NRC Investigation Referral Board; and of recommendations from the Director of the Office of Investigations for strengthening that office's functions.


Harris introduces reliable emergency communications for utilities.

Your backup communications system. You don't need it often, but when you do, it had better back you up.

Now you can be sure in any emergency with reliable high-frequency, point-to-point communications from Harris that will back you up when all other lines are down.

**Introducing the Harris RF-7100 HF Adaptive Communications System.**

This cost-effective, user-friendly system requires only a single point-to-point HF radio link to communicate up to thousands of miles. Now when emergencies strike, you won't have to be concerned with telephone service breakdowns, satellite outages or VHF/UHF repeater failures.

**Instantly adapts to atmospheric conditions.**

Until now, long-distance high-frequency communications have required manual frequency selection. But the Harris Adaptive Communications System automatically selects the optimum transmission frequency to minimize atmospheric propagation problems and operator error.

**No special training necessary.**

Communicating from one station to another is as easy as making a phone call. By simply preprogramming channels, you can link up to any desired location within seconds—just by pushing a button. The system can be connected to a data modem for hard copy as well.

**Let Harris help.**

To find out how the Harris RF-7100 System can help you keep your lines open when all other lines are down, write Harris RF Communications Group, Civil/Industrial Marketing, 1680 University Avenue, Rochester, N.Y. 14610. Or call 1-800-4-HARRIS, ext. 3510.

HARRIS

Inquire R.S. 3

# TMI 1 operates at 100 percent power, hits record

MIDDLETOWN, PA—Three Mile Island Unit 1 has been operating at 100 percent power and generating output has reached 887 MW, the highest output in the plant's history.

Before shutting down for refueling last October, the plant was operating at 100 percent power, with peak generation of 842 MW.

Unit 1's increased output is the result of modifications and maintenance done during the extended refueling and maintenance outage that ended in March. These modifications increased the efficiency of the plant's turbine-generator. These enhancements included modifying the manner in which steam is injected into the turbine, replacing turbine blading and adding insulation to the turbine to reduce heat loss.

However, when unit 1 was returned to service after the outage, it was unable to reach its former maximum production because of mineral deposits in the plant's two steam generators. The deposits interfered with the production of the steam produced to drive the turbine-generator.

A planned shutdown and maintenance effort to redistribute the deposits in early May apparently was successful. The plant, which had been limited to 84 percent power before the planned shutdown, reached 90 percent before a second, unplanned shutdown occurred. That shutdown was caused by an operator who used a wrong switch that initiated the unplanned shutdown. The switching procedure is now under review.

The unit was restarted about four hours later and returned to the regional grid later the same day. It has been operating at 100 percent power since then.

# *Foreign nuclear capacity up 8% in '86*

WASHINGTON—Nuclear generating capacity outside the U.S. rose approximately eight percent last year, according to recent survey results from the Atomic Industrial Forum.

Generating capacity abroad increased to almost 180,000 MW at 285 reactors. AIF said that together with the U.S. nuclear program, nuclear energy accounted for more than 15 percent of the world's electricity supply last year.

Survey results show that in 1986 there were 131 foreign reactors under construction, representing 110,293 MW. (See table.)

France, Japan, Argentina and West Germany actively pressed the export of their nuclear technology. For example, AIF said that Argentina offered Algeria a pressurized heavy water reactor developed from a West German design. The industry group noted that France, West Germany and Japan are aggressively competing to sell reactors and other services to new and expanding foreign nuclear programs.

China ordered two Light Water Reactors last year from Framatome. AIF said the Japanese are in the process of ordering two advanced LWRs, which they have been developing with U.S. manufacturers.

With the addition of Bangladesh and Morocco, there are now 41 countries with firm nuclear electricity programs. However, AIF said several mature programs have been slightly trimmed.

Chart totals for 1985 and 1986 do not include six countries with less-firm programs. MWe figures are not included for "planned" reactors with no size assigned.

| | 1986 Net MWe | Reactors |
|---|---|---|
| Operable | 179,978 | 285 |
| Under Construction | 110,293 | 131 |
| On Order | 8,820 | 9 |
| Planned | 148,500 | 165 |
| Totals | 447,591 | 590 |

| | 1985 (revised) Net MWe | Reactors |
|---|---|---|
| Operable | 166,804 | 272 |
| Under Construction | 111,397 | 134 |
| On Order | 8,820 | 9 |
| Planned | 165,509 | 178 |
| Totals | 452,530 | 593 |

*(Source: "International Reactor Survey", Atomic Industrial Forum)*

## R&D can help . . .

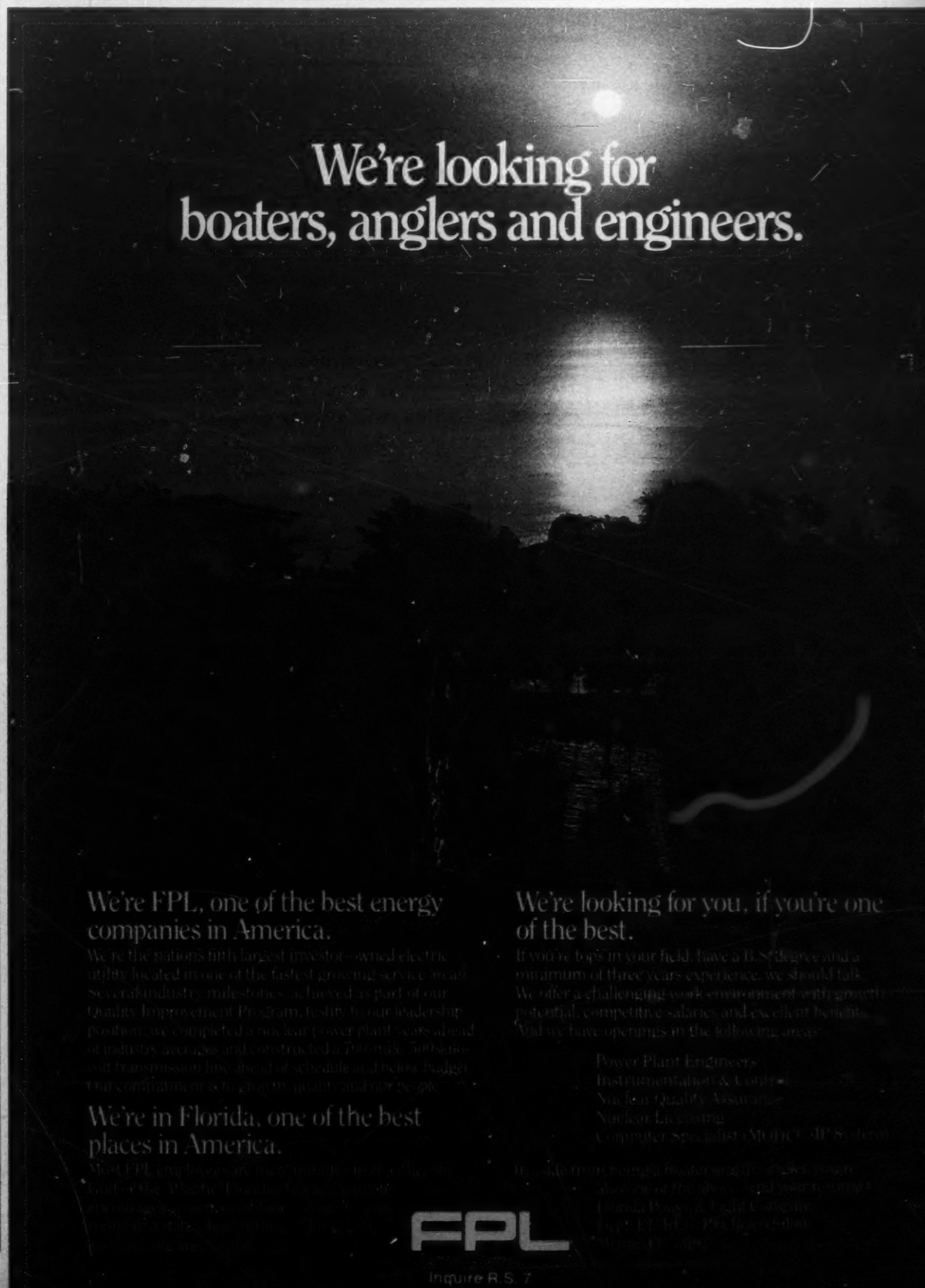
from page 4

Furthermore, said Starr, "these cost estimates do not include benefits resulting from applications to additional utilities nor a broad range of intangible R&D contributions" that have made utilities more cost-effective.

**Prices can be kept reasonable**

With a continuing commitment to R&D, Starr said U.S. electricity prices can be kept at a reasonable level when the plants built before 1970 are replaced.

If all of EPRI's current R&D programs meet their objectives, Starr predicted that the real cost of delivering electricity from new plants might approach half of the present cost.


We're looking for
boaters, anglers and engineers.
We're FPL, one of the best energy companies in America.
We're looking for you, if you're one of the best.
We're in Florida, one of the best places in America.
FPL
Inquire R.S. 7

## 22nd Annual Top 100 Electric Utilities Report

# 1986 results mask lingering utility difficulties

Robert A. Lincicome
Editor-in-Chief

The nation's Top 100 Electric Utilities bounced back a bit in 1986 from the poor performance recorded a year earlier. While revenues declined slightly on essentially flat kilowatthour sales performances, total net income and earnings for common stock improved over 1985.

Significantly, the Top 100 Electric Utilities continued the trend to improved quality of earnings begun two years ago.

And while many utilities enjoyed large percentage improvement in 1986, it must be remembered that in general the reason they look so good is because they looked so bad the year earlier, that they were rebounding. Nevertheless, there were some important, solid performances that should be recognized. Consumers Power, for example, has gone a long way on its recovery road from its Midland nuclear plant cancellation problems. And General Public Utilities appears to have its TMI-2 crisis-days behind it and is now back on a strong financial course.

In general, however, although the industry's 1986 performance improved on 1985 results, performance overall was below that enjoyed in 1984.

These were the broad conclusions revealed in *EL&P's* 22nd Annual Top 100 Electric Utilities survey, completed in April.

### Slow recovery from 1985

While overall performances were mixed and at best were lackluster, they did represent some improvement from 1985's dismal performance, the worst in the 21 year history of the Top 100 Electric Utilities report to that time.

In summary, the Top 100 electric utilities, or their holding companies, reported total revenues from all sources of $149.3 billion, a decrease of 0.53 percent from the $150.1 billion garnered by the Top 100 in 1985. These revenues came on the strength of a 1.96 percent increase in customers, to an all-time high of 77.9 million. Kilowatthour sales growth lagged customer growth, principally reflecting lower industrial electrical usage. KWh sales gained 1.14 percent, to 2.0-trillion kWh from 1.98-trillion a year earlier.

Utility net incomes increased to $17.3-billion, a gain of 11.77 percent from the $15.5-billion posted in 1985. But the 1986 result was still 5 percent below net income performance in 1984. And earnings per share of common stock in 1986 totalled $2.80, a 16-cent per share increase from 1985, but still 47 cents per share, or 14 percent, below the 1984 level.

### KWh sales inch ahead

Kilowatthour sales by the Top 100 Electric Utilities climbed slightly in 1986, to 2.0-trillion kWh. This represents a gain of 1.14 percent. KWh sales in 1985 were just under 1.98-trillion kWh.

Since customer growth was reported to be 1.96 percent, it is clear that kWh sales simply did not keep pace. Although both residential and commercial sales actually increased, the continued lull in manufacturing and industrial activity held total sales figures down.

Last year 62 companies reported increases in kWh sales, but only 10 said their gains exceeded the historic 7-percent per year average rate enjoyed by the industry up until the Arab oil embargo. While the largest gain, by Montana Power, was a healthy 25.98 percent, the median growth was just 1.94 percent, down from the meager 2.1 percent recorded in 1985 and well below the 4.88 percent median kWh sales growth posted in the banner year of 1984.

The ten largest sellers of kWh remained the same as in 1985, although there were minor changes in position (see Table I). Two companies—Commonwealth Edison and Duke Power—each moved up two positions, Commonwealth Edison, which increased sales 2.02 percent, climbed from sixth to fourth, and Duke, which enjoyed a 7.95 percent increase in sales in 1986, rose from eighth to sixth. Pacific Gas & Electric, suffering a 2.27 percent decrease in sales, dropped two positions to seventh. Other changes reflected movements up or down only one rank.

Average residential electrical use also increased slightly in 1986, well below the rate of customer growth and below the growth rate posted in 1986. Average residential use was 8634 kWh in 1986, up 1.12 percent from 8538 in 1985. Use of electricity by residential customers in 1986 remained 2.0 percent below the all-time peak of 8823 kwh in 1984 and 1 percent below the previous record of 8705 kWh established in 1978.

As in the past, the companies posting the highest average residential kWh use tended to be in the low-cost-of-power Northwest, and in the humid Southeast. Leaders were: 1. Idaho Power, 14,541 kWh; 2. Washington Water Power, 13,764 kWh; 3. Puget Sound Power & Light, 13,396 kWh; 4. Nevada Power, 12,933 kWh; and 5. Scana Corp. (South Carolina Electric & Gas); 12,821 kWh.

Conversely, companies ranking lowest in average residential kWh use tended to be in high-cost areas of the country. Companies recording the lowest electrical usage were: 100. Consolidated Edison, 3,511 kWh; 99. San Diego Gas & Electric, 5,256 kWh; 98. Public Service Enterprise Group (Public Service Electric & Gas), 5650 kWh; 97. El Paso Electric, 5,719; and 96. Boston Edison, 5735 kWh.

Total revenues for the Top 100 Electric Utilities fell 0.53 percent in

Continued on page 14

### EARNINGS TABLE

| Company | Rank | % Change From 1985 | 1986 Earnings Per Share, $ | 1985 Earnings Per Share, $ |
|---|---|---|---|---|
| Central Maine Power | 1 | 1825.00 | 1.54 | 0.08 |
| DPL, Inc. | 2 | 208.08 | 3.05 | 0.99 |
| General Public Utilities | 3 | 75.27 | 3.26 | 1.86 |
| Ipalco | 4 | 71.20 | 3.27 | 1.91 |
| IE Industries | 5 | 44.90 | 2.13 | 1.47 |
| Savannah Electric & Power | 6 | 31.72 | 1.91 | 1.45 |
| Central Illinois Light | 7 | 31.54 | 3.67 | 2.79 |
| American Electric Power | 8 | 19.63 | 2.62 | 2.19 |
| Oklahoma Gas & Electric | 9 | 19.57 | 2.75 | 2.30 |
| Minnesota Power | 10 | 18.38 | 2.77 | 2.34 |
| Atlantic Energy | 11 | 16.67 | 3.50 | 3.00 |
| Pennsylvania Power & Light | 12 | 15.67 | 3.10 | 2.68 |
| Potomac Electric Power | 13 | 14.76 | 4.12 | 3.59 |
| Illinois Power | 14 | 14.37 | 3.98 | 3.48 |
| Midwest Energy | 15 | 13.38 | 1.61 | 1.42 |
| Baltimore Gas & Electric | 16 | 12.50 | 3.15 | 2.80 |
| Allegheny Power System | 17 | 12.26 | 4.03 | 3.59 |
| New York State Electric & Gas | 18 | 11.56 | 3.86 | 3.46 |
| Detroit Edison | 19 | 10.73 | 2.58 | 2.33 |
| Dominion Resources | 20 | 10.51 | 4.10 | 3.71 |
| Middle South Utilities | 21 | 9.95 | 2.21 | 2.01 |
| Duke Power | 22 | 8.60 | 4.04 | 3.72 |
| Sierra Pacific Power | 23 | 7.45 | 3.03 | 2.82 |
| Hawaiian Electric Industries | 24 | 7.08 | 2.57 | 2.40 |
| Tucson Electric Power | 25 | 6.90 | 4.65 | 4.35 |
| Southern Indiana Gas & Electric | 26 | 6.00 | 3.18 | 3.00 |
| Eastern Utilities Associates | 27 | 5.62 | 2.82 | 2.67 |
| Central Vermont Public Service | 28 | 5.60 | 3.58 | 3.39 |
| Nevada Power | 29 | 5.56 | 1.71 | 1.62 |
| Delmarva Power & Light | 30 | 5.43 | 2.91 | 2.76 |
| Commonwealth Edison | 31 | 5.39 | 4.69 | 4.45 |
| San Diego Gas & Electric | 32 | 5.23 | 3.42 | 3.25 |
| Kansas Power & Light | 33 | 5.21 | 4.85 | 4.61 |
| Florida Progress | 34 | 5.10 | 3.71 | 3.53 |
| Northern States Power | 35 | 4.04 | 3.09 | 2.97 |
| Empire District Electric | 36 | 4.00 | 2.86 | 2.75 |
| Central & South West | 37 | 3.88 | 3.75 | 3.61 |
| Orange & Rockland Utilities | 38 | 3.56 | 2.91 | 2.81 |
| Louisville Gas & Electric | 39 | 3.49 | 3.26 | 3.15 |
| Iowa Southern Utilities | 40 | 3.02 | 2.73 | 2.65 |
| Boston Edison | 41 | 2.79 | 2.58 | 2.51 |
| Carolina Power & Light | 42 | 2.59 | 3.96 | 3.86 |
| United Illuminating | 43 | 2.58 | 5.97 | 5.82 |
| Cincinnati Gas & Electric | 44 | 2.42 | 3.36 | 3.30 |
| Texas Utilities | 45 | 2.30 | 4.45 | 4.35 |
| Northeast Utilities | 46 | 2.21 | 2.78 | 2.72 |
| Central Illinois Public Service | 47 | 2.08 | 1.96 | 1.92 |
| Pacificorp | 48 | 1.77 | 3.45 | 3.39 |
| New England Electric | 49 | 1.56 | 3.20 | 3.15 |
| Philadelphia Electric | 50 | 1.56 | 2.60 | 2.56 |
| Southwestern Public Service | 51 | 1.10 | 2.75 | 2.72 |
| Union Electric | 52 | 1.05 | 2.89 | 2.86 |
| Ohio Edison | 53 | 0.82 | 2.47 | 2.45 |
| Southern California Edison | 54 | 0.61 | 3.28 | 3.26 |
| Otter Tail Power | 55 | 0.56 | 3.57 | 3.55 |
| Wisconsin Power & Light | 56 | 0.47 | 4.28 | 4.26 |
| Kentucky Utilities | 57 | 0.35 | 2.85 | 2.84 |
| Consolidated Edison | 58 | 0.00 | 4.26 | 4.26 |
| Wisconsin Energy | 59 | -0.21 | 4.74 | 4.75 |
| Public Service of New Mexico | 60 | -0.30 | 3.29 | 3.30 |
| Southern Company | 61 | -0.94 | 3.17 | 3.20 |
| Pacific Gas & Electric | 62 | -1.89 | 2.60 | 2.65 |
| Teco Energy | 63 | -3.63 | 3.45 | 3.58 |
| Central Hudson Gas & Electric | 64 | -3.85 | 4.49 | 4.67 |
| Iowa Resources | 65 | -3.90 | 1.97 | 2.05 |
| Iowa-Illinois Gas & Electric | 66 | -3.93 | 3.91 | 4.07 |
| Central Louisiana Electric | 67 | -4.11 | 3.50 | 3.65 |
| Interstate Power | 68 | -4.65 | 2.05 | 2.15 |
| Madison Gas & Electric | 69 | -5.59 | 2.87 | 3.04 |
| Niagara Mohawk Power | 70 | -5.90 | 2.71 | 2.88 |
| Utilicorp United | 71 | -6.04 | 2.80 | 2.98 |
| FPL Group | 72 | -6.75 | 2.90 | 3.11 |
| Rochester Gas & Electric | 73 | -6.98 | 3.33 | 3.58 |
| Idaho Power | 74 | -7.41 | 2.00 | 2.16 |
| Centerior Energy | 75 | -7.80 | 3.04 | 3.29 |
| Houston Industries | 76 | -7.75 | 3.81 | 4.13 |
| Scana Corp. | 77 | -8.21 | 1.79 | 1.95 |
| Commonwealth Energy System | 78 | -8.44 | 4.12 | 4.50 |
| Wisconsin Public Service | 79 | -8.76 | 4.06 | 4.45 |
| TNP Enterprises | 80 | -10.70 | 1.92 | 2.15 |
| MDU Resources Group | 81 | -10.80 | 1.90 | 2.13 |
| Public Service Enterprise Group | 82 | -13.15 | 2.84 | 3.27 |
| Gulf States Utilities | 83 | -18.57 | 1.71 | 2.10 |
| El Paso Electric | 84 | -19.44 | 2.32 | 2.88 |
| Puget Sound Power & Light | 85 | -19.82 | 1.74 | 2.17 |
| Duquesne Light | 86 | -20.80 | 1.79 | 2.26 |
| AZP Group | 87 | -21.65 | 3.04 | 3.88 |
| Montana Power | 88 | -30.21 | 3.65 | 5.23 |
| Kansas Gas & Electric | 89 | -32.39 | 1.44 | 2.13 |
| Kansas City Power & Light | 90 | -36.51 | 2.80 | 4.41 |
| Utah Power & Light | 91 | -39.84 | 1.48 | 2.46 |
| Long Island Lighting | 92 | -42.57 | 2.28 | 3.97 |
| Washington Water Power | 93 | -81.52 | 0.56 | 3.03 |
| Portland General Electric | 94 | -88.55 | 0.34 | 2.97 |
| Public Service of Colorado | 95 | -92.82 | 0.13 | 1.81 |
| Public Service of Indiana | 96 | NA | -0.94 | -23.17 |
| Consumers Power | 97 | NA | 0.74 | -4.42 |
| Northern Indiana Public Service | 98 | NA | -0.57 | -0.23 |
| Public Service of New Hampshire | 99 | NA | -6.44 | 2.50 |
| Centsi | 100 | NA | NA | NA |

| Company | 1986 Total Sales (KWH) Rank | % Increase | Average Annual Growth 1981 — 1985 | 1986 Sales (KWH) By Type of Customer (% of Sales) Resid. | Comm. | Indus. | Other | Average Annual Residential Use 1986 | 1985 | Ratio of Long-Term Debt to Net Plant 1986 | 1985 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Montana Power | 1 | 25.88 | -0.40 | 18.19 | 26.11 | 16.26 | 39.44 | 8,566 | 9,257 | 45.46 | 46.01 |
| Wisconsin Public Service | 2 | 13.71 | 1.91 | 31.90 | 22.15 | 28.73 | 17.22 | 7,340 | 7,266 | 35.65 | 36.11 |
| Dominion Resources | 3 | 11.69 | 2.24 | 35.64 | 26.92 | 16.64 | 20.80 | NA | NA | 47.24 | 41.71 |
| Florida Progress | 4 | 8.92 | 1.87 | 42.38 | 24.05 | 13.48 | 20.09 | 11,255 | 10,940 | 37.16 | 37.64 |
| Pennsylvania Power & Light | 5 | 8.20 | 4.50 | 28.63 | 23.53 | 26.25 | 21.39 | 9,344 | 9,034 | 42.77 | 40.76 |
| Iowa Resources | 6 | 8.05 | 2.20 | 34.94 | 24.81 | 31.06 | 9.19 | 8,463 | 8,295 | 44.54 | 45.90 |
| Duke Power | 7 | 7.95 | 0.94 | 25.84 | 20.35 | 38.36 | 15.46 | 12,413 | 11,859 | 41.46 | 42.68 |
| Delmarva Power & Light | 8 | 7.92 | 3.07 | 27.11 | 25.75 | 29.91 | 17.22 | 8,605 | 8,059 | 51.07 | 49.65 |
| Southern Indiana Gas & Electric | 9 | 7.83 | -0.56 | 24.44 | 19.60 | 37.48 | 18.39 | 11,341 | 10,696 | 27.71 | 37.18 |
| Baltimore Gas & Electric | 10 | 7.80 | 2.40 | 26.72 | 15.77 | 47.50 | 0.00 | 9,255 | 8,813 | 41.26 | 41.63 |
| Savannah Electric & Power | 11 | 6.95 | -0.63 | 43.01 | 30.44 | 22.66 | 3.89 | 11,514 | 10,536 | 42.09 | 40.53 |
| New England Electric | 12 | 6.74 | 2.12 | 34.69 | 31.77 | 24.18 | 9.36 | 6,500 | 6,302 | 51.99 | 53.72 |
| DPL, Inc. | 13 | 6.69 | 1.16 | 33.34 | 20.68 | 29.66 | 16.32 | 9,994 | 9,599 | 63.37 | 55.71 |
| Kentucky Utilities | 14 | 6.33 | 0.59 | 31.33 | 21.02 | 18.19 | 29.46 | 11,120 | 10,591 | 33.86 | 34.52 |
| Utilicorp United | 15 | 6.09 | 2.54 | 39.76 | 25.91 | 19.97 | 14.37 | 8,861 | 8,369 | 45.26 | 42.17 |
| Hawaiian Electric Industries | 16 | 5.88 | 0.57 | 27.52 | 25.06 | 46.62 | 0.81 | 6,753 | 6,753 | 35.51 | 39.91 |
| Illinois Power | 17 | 5.60 | 0.30 | 27.55 | 18.52 | 46.19 | 5.74 | 8,694 | 8,187 | 41.94 | 42.47 |
| FPL Group | 18 | 5.52 | 2.24 | 50.09 | 38.83 | 7.37 | 3.70 | 11,235 | 10,977 | 38.65 | 40.57 |
| Carolina Power & Light | 19 | 5.52 | 1.49 | 26.12 | 18.42 | 31.98 | 23.48 | 12,170 | 11,522 | 38.09 | 41.77 |
| Central Louisiana Electric | 20 | 5.37 | 0.72 | 39.58 | 18.85 | 34.55 | 7.22 | 11,984 | 11,519 | 42.17 | 37.74 |
| Potomac Electric Power | 21 | 5.34 | 3.51 | 25.50 | 42.14 | 22.84 | 9.53 | 10,022 | 9,338 | 40.47 | 44.74 |
| Atlantic Energy | 22 | 5.19 | 1.85 | 43.54 | 36.82 | 16.75 | 0.89 | 7,982 | 7,843 | 43.46 | 40.66 |
| Scana Corp. | 23 | 5.09 | 2.17 | 32.59 | 25.16 | 32.24 | 9.01 | 12,621 | 11,992 | 33.33 | 35.45 |
| Ipalco | 24 | 5.07 | 2.38 | 31.68 | 23.35 | 43.83 | 0.83 | 10,347 | 9,869 | 40.05 | 41.26 |
| Louisville Gas & Electric | 25 | 5.02 | 0.96 | 32.14 | 26.74 | 29.74 | 11.39 | 9,898 | 9,342 | 39.84 | 39.82 |
| El Paso Electric | 26 | 4.98 | 3.13 | 24.81 | 28.21 | 14.67 | 32.31 | 5,719 | 5,735 | 59.94 | 49.63 |
| Kansas City Power & Light | 27 | 4.84 | 1.36 | 30.45 | 43.27 | 24.30 | 1.97 | 8,563 | 8,197 | 45.30 | 46.74 |
| Long Island Lighting | 28 | 4.44 | 0.94 | 42.71 | 2.11 | 50.58 | 4.60 | 7,260 | 7,018 | 48.85 | 37.16 |
| Iowa Southern Utilities | 29 | 4.33 | 4.54 | 32.05 | 24.34 | 35.82 | 7.80 | 8,007 | 7,774 | 37.47 | 39.28 |
| General Public Utilities | 30 | 4.27 | 0.83 | 33.88 | 27.77 | 34.10 | 4.26 | 7,662 | 7,443 | 38.40 | 43.17 |
| Cincinnati Gas & Electric | 31 | 4.13 | 1.35 | 35.18 | 25.45 | 29.88 | 9.50 | 10,321 | 9,797 | 49.16 | 50.26 |
| Northeast Utilities | 32 | 3.99 | 1.03 | 36.80 | 34.14 | 23.99 | 5.06 | 7,746 | 7,492 | 47.09 | 45.51 |
| Eastern Utilities Associates | 33 | 3.72 | 0.79 | 33.56 | 33.06 | 22.74 | 10.64 | 5,792 | 5,582 | 51.98 | 47.65 |
| Detroit Edison | 34 | 3.67 | 1.57 | 27.58 | 19.72 | 45.32 | 7.38 | 6,350 | 6,165 | 40.47 | 43.78 |
| Central Maine Power | 35 | 3.58 | 4.17 | 34.45 | 22.49 | 41.35 | 1.72 | 7,145 | 7,013 | 53.80 | 52.41 |
| IE Industries | 36 | 3.57 | 1.14 | 32.90 | 25.75 | 33.16 | 8.20 | 8,143 | 7,891 | 35.77 | 41.97 |
| Union Electric | 37 | 3.52 | 2.46 | 32.85 | 32.93 | 26.57 | 5.64 | 10,227 | 9,901 | 43.59 | 43.94 |
| Central Vermont Public Service | 38 | 3.26 | 4.26 | 33.36 | 9.30 | 30.21 | 27.13 | 8,035 | 8,233 | 56.73 | 46.46 |
| Cilcorp | 39 | 3.08 | -1.83 | 31.59 | 23.91 | 42.90 | 1.61 | 8,593 | 8,256 | 37.89 | 39.86 |
| Public Service Enterprise Group | 40 | 3.03 | 1.56 | 26.21 | 42.40 | 30.05 | 1.34 | 5,650 | 5,494 | 37.67 | 37.95 |
| Philadelphia Electric | 41 | 3.01 | 0.80 | 30.71 | 13.88 | 51.99 | 3.43 | 7,097 | 6,820 | 45.20 | 47.43 |
| Nevada Power | 42 | 2.90 | 2.43 | 41.19 | 2.87 | 48.76 | 7.18 | 12,933 | 13,805 | 48.51 | 47.46 |
| Interstate Power | 43 | 2.85 | -1.32 | 22.99 | 18.77 | 51.81 | 6.43 | 7,127 | 7,132 | 44.37 | 48.71 |
| Middle South Utilities | 44 | 2.74 | 1.22 | 29.61 | 19.96 | 33.66 | 16.76 | 11,769 | 11,626 | 54.03 | 47.09 |
| Texas Utilities | 45 | 2.57 | 5.14 | 32.69 | 28.51 | 27.92 | 10.87 | 12,749 | 13,082 | 39.79 | 36.85 |
| Public Service of Colorado | 46 | 2.24 | 2.67 | 28.38 | 47.81 | 18.41 | 5.40 | 5,936 | 6,230 | 34.64 | 37.52 |
| Consolidated Edison | 47 | 2.03 | 1.75 | 26.94 | 66.76 | 4.76 | 1.54 | 3,511 | 3,386 | 36.51 | 36.48 |
| Commonwealth Edison | 48 | 2.02 | 0.85 | 27.86 | 29.97 | 30.96 | 11.19 | 6,525 | 6,458 | 36.08 | 37.11 |
| Kansas Gas & Electric | 49 | 1.99 | -0.11 | 26.85 | 21.89 | 35.26 | 16.01 | 9,202 | 9,435 | 53.26 | 54.48 |
| United Illuminating | 50 | 1.94 | 1.19 | 34.61 | 38.98 | 25.06 | 1.33 | 6,356 | 6,265 | 48.54 | 53.01 |
| Centerior Energy | 51 | 1.85 | 0.17 | 25.77 | 24.63 | 45.05 | 4.55 | 7,348 | 7,169 | 94.86 | 96.76 |
| Consumers Power | 52 | 1.76 | -0.17 | 31.31 | 26.26 | 41.60 | 0.82 | 6,852 | 6,733 | 86.45 | 93.82 |
| Puget Sound Power & Light | 53 | 1.54 | 0.73 | 47.02 | 28.11 | 17.26 | 7.61 | 13,396 | 14,252 | 58.60 | 53.94 |
| Madison Gas & Electric | 54 | 1.45 | 0.32 | 28.18 | 53.62 | 5.32 | 12.88 | 6,222 | 6,192 | 48.66 | 43.57 |
| Commonwealth Energy System | 55 | 1.21 | 2.34 | 25.56 | 26.51 | 7.59 | 40.34 | 5,915 | 5,946 | 38.73 | 35.30 |
| Wisconsin Energy | 56 | 1.11 | 1.07 | 30.05 | 26.11 | 33.82 | 10.02 | 7,461 | 7,367 | 50.38 | 36.41 |
| Public Serice of Indiana | 57 | 1.11 | -0.62 | 28.55 | 23.03 | 33.96 | 14.46 | 10,777 | 10,347 | 62.72 | 76.32 |
| American Electric Power | 58 | 1.07 | -2.21 | 22.87 | 15.82 | 33.66 | 27.65 | 10,099 | 10,014 | 51.12 | 53.86 |
| Iowa-Illinois Gas & Electric | 59 | 1.00 | 0.10 | 23.40 | 26.70 | 43.00 | 6.90 | 6,454 | 6,040 | 35.09 | 37.95 |
| San Diego Gas & Electric | 60 | 0.57 | 2.41 | 36.89 | 35.67 | 23.78 | 3.67 | 5,256 | 5,413 | 36.70 | 38.35 |
| Sierra Pacific Power | 61 | 0.32 | 1.20 | 31.82 | 39.46 | 25.11 | 3.62 | 7,186 | 7,477 | 41.76 | 40.77 |
| Northern States Power | 62 | 0.19 | 2.94 | 27.54 | 15.14 | 44.96 | 12.53 | 7,540 | 7,470 | 35.33 | 37.47 |
| Kansas Power & Light | 63 | -0.26 | 0.14 | 22.67 | 27.55 | 19.90 | 29.88 | 8,109 | 7,984 | 32.31 | 33.87 |
| Portland General | 64 | -0.38 | 3.06 | 31.69 | 25.58 | 17.45 | 25.28 | 11,987 | 12,781 | 57.88 | 46.56 |
| Midwest Energy | 65 | -0.42 | -1.09 | 35.76 | 27.41 | 25.00 | 11.83 | 7,089 | 7,267 | 43.87 | 45.65 |
| Public Service of New Hampshire | 66 | -0.60 | 3.26 | 30.38 | 13.43 | 29.88 | 26.33 | 7,119 | 6,969 | 55.83 | 45.57 |
| AZP Group | 67 | -0.77 | 1.40 | 33.88 | 36.99 | 19.01 | 10.12 | 10,176 | 10,499 | 39.32 | 45.26 |
| Southwestern Public Service | 68 | -0.87 | 6.92 | 13.39 | 14.82 | 36.53 | 35.27 | 7,672 | 7,574 | 39.52 | 39.51 |
| Wisconsin Power & Light | 69 | -0.88 | 4.69 | 26.26 | 15.43 | 28.56 | 29.74 | 8,105 | 8,152 | 41.21 | 42.07 |
| Central Hudson Gas & Electric | 70 | -0.94 | -1.89 | 26.46 | 23.92 | 32.92 | 16.69 | 6,491 | 6,254 | 114.53 | 119.77 |
| Southern California Edison | 71 | -1.21 | 0.81 | 29.23 | 33.11 | 31.11 | 6.54 | 5,999 | 6,099 | 44.10 | 46.21 |
| Centel | 72 | -1.30 | -0.59 | 27.57 | 29.11 | 21.89 | 21.44 | 6,492 | 6,686 | 0.00 | 0.00 |
| Orange & Rockland Utilities | 73 | -1.47 | 3.34 | 32.20 | 22.04 | 29.87 | 15.89 | 6,385 | 6,182 | 41.71 | 41.14 |
| Southern Company | 74 | -2.10 | 6.76 | 23.08 | 18.96 | 32.40 | 25.55 | 11,145 | 10,514 | 45.29 | 46.68 |
| TNP Enterprises | 75 | -2.12 | 5.03 | 26.95 | 19.67 | 51.27 | 2.11 | 10,465 | 10,430 | 36.06 | 39.47 |
| Pacific Gas & Electric | 76 | -2.27 | -0.68 | 35.99 | 36.57 | 27.44 | 0.00 | 6,343 | 6,533 | 49.95 | 60.31 |
| Ohio Edison | 77 | -2.49 | 3.43 | 25.02 | 19.74 | 30.29 | 24.95 | 7,924 | 7,682 | 38.55 | 40.73 |
| Duquesne Light | 78 | -2.61 | -0.95 | 23.37 | 37.34 | 21.61 | 17.67 | 5,821 | 5,621 | 46.26 | 45.35 |
| Niagara Mohawk Power | 79 | -2.69 | 1.46 | 27.25 | 30.20 | 31.45 | 11.10 | 7,249 | 7,046 | 43.30 | 45.06 |
| MDU Resources Group | 80 | -2.83 | 2.66 | 39.59 | 24.66 | 31.93 | 3.81 | 7,517 | 7,788 | 43.45 | 38.64 |
| Houston Industries | 81 | -3.50 | -0.32 | 27.08 | 21.18 | 48.50 | 3.24 | 12,675 | 12,961 | 35.48 | 37.98 |
| Central & South West | 82 | -3.91 | -0.09 | 29.14 | 24.59 | 32.76 | 13.51 | 10,328 | 10,398 | 34.95 | 36.04 |
| Empire District Electric | 83 | -4.25 | 5.34 | 30.71 | 21.54 | 19.60 | 28.15 | 9,759 | 9,463 | 36.12 | 32.98 |
| Teco Energy | 84 | -4.45 | 1.83 | 39.96 | 29.36 | 23.32 | 7.33 | 12,590 | 12,571 | 35.86 | 35.76 |
| Boston Edison | 85 | -5.60 | 2.18 | 22.57 | 46.95 | 13.60 | 16.88 | 5,735 | 5,512 | 43.09 | 49.14 |
| Rochester Gas & Electric | 86 | -5.74 | 1.27 | 28.21 | 24.73 | 26.50 | 20.56 | 6,759 | 6,711 | 44.72 | 47.13 |
| Oklahoma Gas & Electric | 87 | -5.86 | -1.69 | 32.00 | 22.46 | 28.30 | 17.25 | 10,591 | 11,097 | 38.04 | 38.60 |
| Washington Water Power | 88 | -6.26 | -0.74 | 33.55 | 21.72 | 13.72 | 31.01 | 13,674 | 14,977 | 52.15 | 45.53 |
| Minnesota Power | 89 | -6.42 | -1.50 | 10.89 | 9.84 | 62.11 | 17.16 | 8,264 | 8,123 | 52.17 | 51.84 |
| New York State Electric & Gas | 90 | -6.54 | 0.05 | 31.20 | 18.06 | 18.89 | 31.86 | 7,539 | 7,367 | 53.51 | 51.92 |
| Northern Indiana Public Service | 91 | -6.92 | -0.84 | 19.49 | 4.33 | 73.37 | 2.81 | 6,708 | 6,531 | 49.02 | 48.39 |
| Gulf States Utilities | 92 | -7.16 | -0.79 | 24.89 | 19.84 | 49.02 | 6.25 | 12,731 | 12,906 | 54.11 | 49.64 |
| Utah Power & Light | 93 | -8.13 | 5.56 | 20.35 | 17.49 | 40.54 | 21.62 | 7,907 | 8,206 | 44.51 | 40.82 |
| Idaho Power | 94 | -8.23 | 5.15 | 24.22 | 13.10 | 24.66 | 38.03 | 14,541 | 15,432 | 41.05 | 43.13 |
| Pacificorp | 95 | -8.51 | 2.52 | 28.21 | 21.84 | 31.81 | 20.33 | 11,429 | 12,267 | 53.72 | 53.63 |
| Central Illinois Public Service | 96 | -9.29 | -0.25 | 30.87 | 13.13 | 44.06 | 11.95 | 7,591 | 7,280 | 40.23 | 39.66 |
| Public Service of New Mexico | 97 | -9.54 | 5.82 | 20.13 | 27.18 | 12.52 | 40.17 | 5,822 | 5,925 | 47.37 | 52.65 |
| Otter Tail Power | 98 | -11.12 | 3.91 | 31.07 | 16.46 | 37.10 | 15.37 | 9,966 | 10,190 | 31.31 | 36.84 |
| Allegheny Power System | 99 | -13.16 | 1.27 | 23.90 | 13.85 | 35.77 | 26.49 | 9,285 | 8,998 | 42.96 | 43.96 |
| Tucson Electric Power | 100 | -15.84 | 10.89 | 27.58 | 17.93 | 35.90 | 18.59 | 7,966 | 8,083 | 60.10 | 64.61 |

**TABLE I**
**THE TOP 10 IN KWH SALES**

| Rank '86 | Rank '85 | Company | KWH Sales (millions) | '86 % Change |
|---|---|---|---|---|
| 1 | 1 | Southern Company | $123,412 | -2.10 |
| 2 | 2 | American Electric Power | 101,584 | 1.07 |
| 3 | 3 | Texas Utilities | 75,255 | 2.57 |
| 4 | 6 | Commonwealth Edison | 65,117 | 2.02 |
| 5 | 4 | Southern California Edison | 64,197 | -1.21 |
| 6 | 8 | Duke Power | 60,513 | 7.95 |
| 7 | 5 | Pacific Gas & Electric | 58,207 | -2.27 |
| 8 | 7 | Middle South Utilities | 57,807 | 2.74 |
| 9 | 10 | FPL Group | 54,276 | 5.52 |
| 10 | 9 | Houston Industries | 54,008 | -3.50 |

1986, to $1.49.3-billion. In 1985, revenues were $150.1-billion. Revenues included funds from all activities for each of the companies reporting, including those of both regulated and non-regulated subsidiaries of utility holding companies.

Several factors are reflected here. First, kWh sales increased only marginally. Second, there were a number of rate adjustments and redesigns during the year that acted to maintain rate stability or reduce rates. And finally, reduced fuel prices were reflected in reduced collections of fuel adjustment charges.

Fifty-nine companies reported decreased revenues during 1986. Twenty-five of these also reported decreases in their kWh sales. The balance saw revenues reduced because of rate action, reduced collections for fuel adjustments, and reduced revenues of "other" activities, including those of non-utility subsidiary operations.

The largest revenue gains were posted by Utilicorp United, the small, but rapidly expanding holding company formed by Missouri Public Service. Utilicorp United enjoyed revenues that grew by 145 percent in 1986, to $596-million, largely through acquisitions of gas utility properties. Ranking second, with a 52.7 improvement, was Midwest Energy, the holding company formed by Iowa Public Service Co., which enjoyed a large increase in gas revenues through acquisition and through subsidiary activities, despite lower electric revenues. The third-fastest revenue producer was Kansas Gas & Electric Co., which recorded most of its gain on the basis of electric rate adjustments.

At the other end of the scale, the utilities suffering the largest revenue declines were Gulf States Utilities, down 20.5 percent on fewer electric and gas customers and reduced electric and gas sales; TNP Enterprises, down 17.1 percent largely on reduced sales; and Washington Water Power, off 15.2 percent on the basis of lower electric sales to residential and "other" customers and substantially reduced gas sales.

There were only two changes among the rankings of the ten largest revenue producers (see Table II). Commonwealth Edison, which increased its revenues 10.4 percent to $5.5 billion, replaced Consolidated Edison as the third largest revenue producer, and Con Ed, which suffered a 5.5 percent decrease in revenues in 1986, dropped to fifth, where Commonwealth Edison had been in 1985. The other eight companies ranked the same in 1986 as in 1985.

Net incomes available for common stock posted by the Top 100 Electric Utilities increased 11.8 percent in

| Rank '86 | Rank '85 | Company | '86 Revenues (millions) | '86 % Change |
|---|---|---|---|---|
| 1 | 1 | Pacific Gas & Electric | $7,817 | -7.3 |
| 2 | 2 | Southern Company | 6,847 | 0.48 |
| 3 | 5 | Commonwealth Edison | 5,479 | 10.4 |
| 4 | 4 | Southern California Edison | 5,319 | 2.8 |
| 5 | 3 | Consolidated Edison | 5,198 | -5.5 |
| 6 | 6 | American Electric Power | 4,843 | -0.1 |
| 7 | 7 | Public Service Enterprises | 4,488 | 1.6 |
| 8 | 8 | FPL Group | 4,092 | -5.9 |
| 9 | 9 | Texas Utilities | 3,932 | -5.7 |
| 10 | 10 | Houston Industries | 3,536 | -19.5 |

1986, to $17.3 billion. While this might seem to be a healthy enough gain, it must be remembered that 1985 was the worst year in the then-21 year history of the Top 100 report.

A year ago, we reported that net income for the Top 100 fell for the first time, dropping 14.8 percent from 1984. With the gain in 1986, total net income still is below that posted in 1984. Thus, 1986 was a year of only partial recovery for net incomes.

But while the general performance was less than spectacular, many utilities managed to improve the quality of their earnings, continuing the trend that began two years ago. For most of the Top 100 utilities, completion of major generation construction projects and the resultant reductions in Allowances for Funds Used During Construction have had a substantial effect on the quality of their earnings.

Overall, 64 utilities reported gains in net income production, compared with 65 a year ago. And the median reported net income increase was 4.7 percent, marginally below last year's median of 4.9 percent, but well below the median gain of 13.8 percent recorded in 1984.

Three utilities—Public Service of New Hampshire, Public Service Indiana and Northern Indiana Public Service—posted losses in 1986 resulting from their nuclear programs or former nuclear programs. But Consumers Power, saddled with huge writeoffs for its cancelled Midland nuclear plant last year, made a turnaround, going from a $390-million loss in 1985 to a $65-million net income in 1986 And Central Maine, which posted a $1.6-million income in 1985 turned around with a $35-million performance.

There were several changes in the rankings of the largest income producers (see Table III), the foremost of which was the movement of Commonwealth Edison into first position on the strength of an 11.1 percent gain, to $933-million. CECo replaced Pacific Gas & Electric, which slipped to second. There also was movement among the companies ranked seventh through tenth.

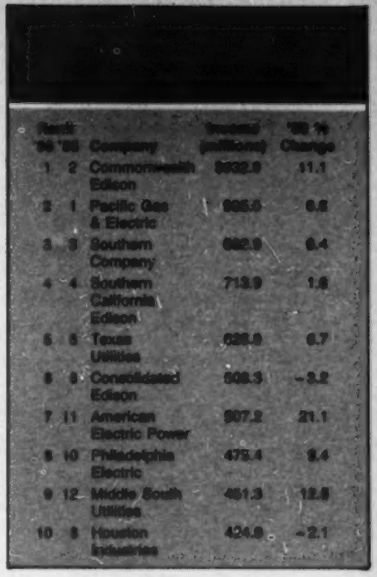
### Earnings gain

Average earnings per share of common stock increased 16 cents per-share, or 6.1 percent from 1985. Average earnings in 1986 were $2.80, compared with $2.64 in 1985. But per-share earnings in 1985 had tumbled 19.3 percent from the 1984 high of $3.27, which means that even with the 1986 recovery, per-share earnings still were some 14.4 percent below the 1984 level.

The per-share figures were based

| Company | Net Income Rank | Net Income % Gain | Revenue Rank | Revenue % Gain | Sales (KWH) Rank | Sales (KWH) % Gain | Int. Cov. Ratio 1986 | Int. Cov. Ratio 1985 | Earnings Per Share $ 1986 | Price/Share 1986 (Dollars) High | Price/Share 1986 (Dollars) Low | % Change Long-Term Debt '85-'86 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central Maine Power | 1 | 2,020.65 | 78 | -6.19 | 36 | 3.58 | 0.71 | 0.03 | 1.54 | 20.000 | 13.375 | -19.47 |
| DPL, Inc. | 2 | 215.96 | 59 | -2.37 | 13 | 6.69 | 1.36 | 0.48 | 3.06 | 29.125 | 19.500 | 13.28 |
| Public Service of Indiana | 3 | 95.94 | 16 | 7.60 | 57 | 1.11 | -0.33 | -7.28 | (0.94) | 16.625 | 7.250 | -19.02 |
| General Public Utilities | 4 | 75.27 | 62 | -2.87 | 30 | 4.27 | 1.27 | 0.74 | 3.26 | 25.000 | 16.500 | -4.86 |
| Ipalco | 5 | 73.08 | 14 | 8.75 | 24 | 5.07 | 1.37 | 1.33 | 3.27 | 29.500 | 18.500 | -0.40 |
| IE Industries | 6 | 49.75 | 82 | -7.05 | 36 | 3.57 | 1.24 | 0.78 | 2.13 | 27.750 | 23.375 | -13.24 |
| Savannah Electric & Power | 7 | 33.86 | 11 | 10.62 | 11 | 6.95 | 1.12 | 0.83 | 1.91 | 23.125 | 10.750 | 7.00 |
| Cilcorp | 8 | 31.58 | 52 | -1.62 | 39 | 3.08 | 1.91 | 1.56 | 3.67 | 42.500 | 26.500 | -4.87 |
| Illinois Power | 9 | 23.76 | 33 | 1.41 | 17 | 5.60 | 1.29 | 1.19 | 3.98 | 32.000 | 23.125 | 13.25 |
| Oklahoma Gas & Electric | 10 | 23.19 | 37 | 0.56 | 87 | -5.86 | 1.77 | 1.64 | 2.75 | 36.750 | 26.125 | 14.01 |
| American Electric Power | 11 | 21.14 | 42 | -0.11 | 58 | 1.07 | 1.01 | 0.75 | 2.62 | 31.500 | 22.750 | -5.86 |
| Minnesota Power | 12 | 21.02 | 65 | -4.21 | 89 | -6.42 | 2.09 | 1.71 | 2.77 | 31.750 | 29.500 | 0.53 |
| Atlantic Energy | 13 | 18.05 | 38 | 0.56 | 22 | 5.19 | 1.71 | 1.52 | 3.50 | 46.625 | 28.250 | 13.15 |
| Pennsylvania Power & Light | 14 | 15.92 | 10 | 10.75 | 5 | 6.20 | 0.75 | 0.65 | 3.10 | 43.375 | 27.615 | 6.57 |
| Dominion Resources | 15 | 15.30 | 7 | 12.13 | 3 | 11.89 | 1.24 | 1.22 | 4.10 | NA | NA | 21.90 |
| Boston Edison | 16 | 14.87 | 67 | -4.84 | 85 | -5.80 | 1.30 | 1.01 | 2.58 | 28.000 | 21.125 | -8.30 |
| Potomac Electric Power | 17 | 14.86 | 24 | 4.17 | 21 | 5.34 | 2.03 | 1.87 | 4.12 | 59.250 | 33.750 | -6.28 |
| Allegheny Power System | 18 | 14.20 | 61 | -6.91 | 99 | -13.16 | 1.54 | 1.35 | 4.03 | 53.875 | 31.625 | -1.03 |
| Utilicorp United | 19 | 13.99 | 1 | 145.04 | 15 | 6.09 | 0.94 | 1.67 | 2.80 | 33.950 | 21.625 | 15.34 |
| New York State Electric & Gas | 20 | 13.75 | 25 | 2.86 | 90 | -6.54 | 1.25 | 1.11 | 3.86 | 38.500 | 27.250 | 10.28 |
| Midwest Energy | 21 | 13.46 | 2 | 52.71 | 65 | -0.42 | 1.06 | 1.06 | 1.61 | 28.000 | 15.625 | 0.79 |
| Detroit Edison | 22 | 13.18 | 35 | 1.10 | 34 | 3.87 | 0.85 | 0.80 | 2.58 | 19.375 | 15.375 | -3.03 |
| Ohio Edison | 23 | 13.13 | 45 | -0.73 | 77 | -2.49 | 0.90 | 0.79 | 2.47 | 22.500 | 15.875 | 3.34 |
| Baltimore Gas & Electric | 24 | 12.85 | 21 | 4.52 | 10 | 7.80 | 2.06 | 1.86 | 3.18 | 39.875 | 23.000 | 2.39 |
| Florida Progress | 25 | 12.62 | 8 | 13.41 | 4 | 8.92 | 1.57 | 1.33 | 3.71 | 47.000 | 30.250 | -0.03 |
| Middle South Utilities | 26 | 12.55 | 15 | 7.84 | 44 | 2.74 | 0.62 | 0.53 | 2.21 | 14.375 | 10.500 | 5.32 |
| Carolina Power & Light | 27 | 11.18 | 19 | 5.48 | 18 | 5.52 | 1.34 | 1.22 | 3.96 | 42.750 | 28.625 | 0.80 |
| Commonwealth Edison | 28 | 11.11 | 12 | 10.36 | 48 | 2.02 | 1.34 | 1.28 | 4.89 | 35.750 | 28.625 | 11.20 |
| Central Hudson Gas & Electric | 29 | 10.81 | 95 | -13.12 | 70 | -0.94 | 1.67 | 1.56 | 4.49 | 39.875 | 28.625 | -1.13 |
| Hawaiian Electric Industries | 30 | 10.38 | 96 | -13.92 | 16 | 5.88 | 1.29 | 1.29 | 2.57 | 35.500 | 24.500 | -7.03 |
| Nevada Power | 31 | 9.54 | 18 | 6.31 | 42 | 2.90 | 1.35 | 1.35 | 1.71 | 25.250 | 15.125 | 6.43 |
| Philadelphia Electric | 32 | 9.35 | 23 | 4.25 | 41 | 3.01 | 1.29 | 2.22 | 2.60 | 25.125 | 16.875 | -0.52 |
| Eastern Utilities Associates | 33 | 9.14 | 27 | 2.94 | 33 | 3.72 | 0.77 | 0.78 | 2.82 | 39.500 | 25.750 | 48.44 |
| Tucson Electric Power | 34 | 8.76 | 88 | -4.90 | 100 | -15.84 | 4.51 | 5.19 | 4.65 | 65.000 | 41.000 | 26.63 |
| Central Vermont Public Service | 35 | 8.74 | 6 | 11.90 | 38 | 3.26 | 21.89 | 30.02 | 3.58 | 29.250 | 21.000 | -4.44 |
| Duke Power | 36 | 8.60 | 4 | 17.32 | 7 | 7.96 | 1.57 | 1.48 | 4.04 | 52.000 | 34.875 | 0.89 |
| Public Service of New Mexico | 37 | 8.50 | 34 | 1.16 | 97 | -9.54 | 1.60 | 1.23 | 3.29 | 37.875 | 28.000 | -21.15 |
| Scana Corp. | 38 | 7.58 | 46 | -0.75 | 23 | 5.08 | 1.70 | 1.36 | 3.03 | 42.875 | 27.125 | -5.04 |
| Empire District Electric | 39 | 7.57 | 22 | 4.33 | 83 | -4.26 | 1.96 | 1.83 | 2.86 | 36.000 | 23.150 | -3.28 |
| Southern Indiana Gas & Electric | 40 | 6.98 | 30 | 2.45 | 9 | 7.53 | 1.49 | 2.18 | 3.18 | 41.250 | 25.500 | -24.40 |
| Pacific Gas & Electric | 41 | 6.75 | 84 | -7.29 | 76 | -2.27 | 1.28 | 1.29 | 2.80 | 27.500 | 18.750 | 1.53 |
| Pacificorp | 42 | 6.66 | 25 | 4.15 | 95 | -8.51 | 0.66 | 0.66 | 3.45 | 38.000 | 30.125 | 0.51 |
| Texas Utilities | 43 | 6.65 | 72 | -5.71 | 45 | 2.57 | 1.82 | 1.86 | 4.45 | 37.500 | 29.500 | 18.48 |
| San Diego Gas & Electric | 44 | 6.62 | 76 | -6.01 | 60 | 0.57 | 1.70 | 1.58 | 3.42 | 42.500 | 28.750 | -0.10 |
| Southern Company | 45 | 6.42 | 40 | 0.48 | 74 | -2.10 | 1.12 | 1.07 | 3.17 | 27.250 | 20.375 | 7.18 |
| Louisville Gas & Electric | 46 | 6.33 | 56 | -2.10 | 25 | 5.02 | 1.35 | 1.32 | 3.26 | 44.375 | 29.000 | 4.73 |
| Kansas Power & Light | 47 | 6.01 | 93 | -11.46 | 53 | -0.26 | 1.60 | 1.50 | 4.86 | 65.000 | 39.625 | -2.75 |
| Delmarva Power & Light | 48 | 5.57 | 49 | -1.10 | 8 | 7.92 | 1.60 | 1.74 | 2.91 | 38.125 | 25.375 | 4.53 |
| New England Electric | 49 | 4.83 | 47 | -0.86 | 12 | 6.74 | 1.97 | 2.10 | 3.20 | 35.250 | 24.375 | 2.40 |
| Northern States Power | 50 | 4.69 | 43 | -0.40 | 62 | 0.19 | 2.04 | 2.10 | 3.09 | 40.125 | 25.000 | 3.15 |
| Central & South West | 51 | 4.54 | 74 | -5.74 | 82 | -3.91 | 1.48 | 1.33 | 3.75 | 37.500 | 26.500 | 3.37 |
| Cincinnati Gas & Electric | 52 | 4.47 | 39 | 0.50 | 31 | 4.13 | 1.37 | 1.36 | 3.36 | 31.125 | 20.375 | 0.87 |
| Northeast Utilities | 53 | 4.28 | 58 | -2.35 | 32 | 3.99 | 1.26 | 1.27 | 2.78 | 28.250 | 17.375 | 2.22 |
| United Illuminating | 54 | 4.18 | 87 | -8.51 | 50 | 1.94 | 0.91 | 1.02 | 5.97 | 36.250 | 26.625 | 1.78 |
| Orange & Rockland Utilities | 55 | 3.47 | 88 | -9.33 | 73 | -1.47 | 1.49 | 1.94 | 2.91 | 40.000 | 26.250 | 16.29 |
| Southwestern Public Service | 56 | 3.33 | 61 | -2.83 | 68 | -0.87 | 1.91 | 2.23 | 2.75 | 37.875 | 22.000 | -0.20 |
| Union Electric | 57 | 2.53 | 5 | 13.53 | 37 | 3.52 | 1.19 | 1.13 | 2.89 | 31.750 | 20.875 | -0.76 |
| Otter Tail Power | 58 | 2.44 | 53 | -1.84 | 96 | -11.12 | 1.62 | 1.56 | 3.57 | 49.250 | 32.500 | -13.83 |
| Central Illinois Public Service | 59 | 2.17 | 91 | -10.60 | 96 | -9.29 | 1.76 | 1.70 | 1.96 | 30.750 | 19.750 | 0.56 |
| Southern California Edison | 60 | 1.84 | 29 | 2.76 | 71 | -1.21 | 1.57 | 1.56 | 3.26 | 36.750 | 25.250 | 0.18 |
| Iowa Southern Utilities | 61 | 0.76 | 48 | -0.99 | 29 | 4.33 | 1.82 | 1.75 | 2.73 | 36.750 | 22.875 | -5.44 |
| Wisconsin Power & Light | 62 | 0.54 | 63 | -3.34 | 69 | -0.98 | 1.84 | 2.71 | 4.26 | 60.250 | 39.000 | 0.09 |
| Kentucky Utilities | 63 | 0.40 | 31 | 2.36 | 14 | 6.33 | 1.46 | 1.40 | 2.85 | 48.125 | 30.000 | -2.50 |
| Iowa-Illinois Gas & Electric | 64 | 0.29 | 66 | -4.23 | 59 | 1.00 | 1.63 | 1.43 | 3.91 | 46.750 | 34.500 | -8.78 |
| Wisconsin Energy | 65 | (0.41) | 55 | -2.06 | 56 | 1.11 | 2.48 | 2.80 | 4.74 | 64.500 | 38.275 | 29.70 |
| Teco Energy | 66 | (1.11) | 20 | 4.73 | 84 | -4.45 | 1.08 | 1.85 | 3.45 | 54.875 | 34.000 | 1.28 |
| FPL Group | 67 | (1.84) | 75 | -5.92 | 18 | 5.52 | 1.22 | 1.18 | 2.90 | 38.000 | 26.375 | -1.99 |
| Central Louisiana Electric | 68 | (2.11) | 73 | -5.74 | 20 | 5.37 | 1.20 | 1.39 | 3.50 | 38.000 | 28.500 | 18.62 |
| Houston Industries | 69 | (2.12) | 94 | -12.95 | 81 | -3.50 | 1.76 | 1.89 | 3.81 | 37.000 | 27.250 | 1.63 |
| Niagara Mohawk Power | 70 | (2.22) | 80 | -1.28 | 79 | -2.69 | 1.23 | 1.32 | 2.71 | 25.500 | 15.500 | 6.83 |
| Centerior Energy | 71 | (2.37) | 28 | 3.83 | 51 | 1.85 | 0.97 | 1.09 | 3.04 | 27.750 | 22.125 | 10.23 |
| Interstate Power | 72 | (2.69) | 57 | -2.16 | 43 | 2.86 | 0.95 | 1.09 | 2.05 | 31.625 | 21.125 | -9.34 |
| Iowa Resources | 73 | (3.14) | 51 | -1.41 | 6 | 8.05 | 1.46 | 1.11 | 1.97 | 27.500 | 17.375 | -4.45 |
| Consolidated Edison | 74 | (3.24) | 70 | -5.46 | 47 | 2.03 | 2.56 | 2.79 | 4.26 | 52.875 | 37.625 | 3.27 |
| Sierra Pacific Power | 75 | (3.32) | 44 | -0.67 | 61 | 0.32 | 1.08 | 1.19 | 1.79 | 29.000 | 19.125 | 7.23 |
| Rochester Gas & Electric | 76 | (3.64) | 36 | 0.74 | 86 | -5.74 | 1.81 | 1.86 | 3.33 | 29.875 | 21.250 | 0.99 |
| Madison Gas & Electric | 77 | (4.20) | 77 | -6.04 | 54 | 1.45 | 1.78 | 1.90 | 2.87 | 41.500 | 27.125 | 20.40 |
| Public Service Enterprise Group | 78 | (5.30) | 32 | 1.58 | 40 | 3.03 | 1.19 | 1.38 | 2.84 | 48.250 | 30.750 | 4.63 |
| Idaho Power | 79 | (6.21) | 89 | -9.38 | 94 | -8.23 | 1.20 | 1.34 | 2.00 | 30.875 | 22.750 | -4.90 |
| Commonwealth Energy System | 80 | (6.40) | 90 | -9.81 | 55 | 1.21 | 1.96 | 2.47 | 4.12 | 45.750 | 29.250 | 22.70 |
| TNP Enterprises | 81 | (7.70) | 99 | -17.11 | 75 | -2.12 | 1.14 | 1.25 | 1.92 | 24.000 | 19.375 | -0.96 |
| Wisconsin Public Service | 82 | (9.15) | 83 | -7.24 | 2 | 13.71 | 2.24 | 2.68 | 4.06 | 63.000 | 38.375 | -6.44 |
| Gulf States Utilities | 83 | (11.45) | 100 | -20.45 | 92 | -7.16 | 0.62 | 0.75 | 1.71 | 15.000 | 7.000 | 12.77 |
| Duquesne Light | 84 | (15.40) | 54 | -2.04 | 78 | -2.61 | 0.77 | 1.01 | 1.79 | 19.375 | 12.125 | 4.11 |
| Puget Sound Power & Light | 85 | (15.81) | 41 | 0.09 | 53 | 1.54 | 1.50 | 1.98 | 1.74 | 25.250 | 17.625 | 1.46 |
| AZP Group | 86 | (16.23) | 17 | 6.42 | 67 | -0.77 | 1.25 | 1.84 | 3.04 | 32.000 | 26.000 | -12.58 |
| MDU Resources Group | 87 | (16.45) | 92 | -10.96 | 80 | -2.83 | 0.82 | 0.82 | 1.90 | 27.875 | 19.375 | 14.55 |
| El Paso Electric | 88 | (17.16) | 80 | -6.33 | 26 | 4.98 | 0.96 | 1.27 | 2.32 | 19.750 | 13.500 | -1.03 |
| Washington Water Power | 89 | (23.33) | 98 | -15.15 | 88 | -6.26 | 2.11 | 1.48 | 0.58 | 31.625 | 24.250 | 0.00 |
| Montana Power | 90 | (27.75) | 13 | 8.96 | 1 | 25.98 | 1.13 | 1.58 | 3.66 | 43.375 | 31.375 | -4.05 |
| Kansas Gas & Electric | 91 | (29.80) | 3 | 20.83 | 49 | 1.99 | 0.58 | 1.37 | 1.44 | 23.500 | 14.000 | -4.65 |
| Kansas City Power & Light | 92 | (35.10) | 9 | 11.44 | 27 | 4.84 | 0.86 | 1.31 | 2.80 | 32.250 | 22.125 | -4.49 |
| Utah Power & Light | 93 | (37.67) | 71 | -5.51 | 93 | -8.13 | 0.76 | 1.23 | 1.48 | 37.250 | 24.875 | 11.49 |
| Long Island Lighting | 94 | (42.60) | 64 | -3.57 | 28 | 4.44 | 0.82 | 1.17 | 2.28 | 14.625 | 8.000 | 40.01 |
| Portland General Electric | 95 | (98.26) | 86 | -8.08 | 64 | -0.38 | 0.20 | 1.41 | 0.34 | 36.750 | 21.875 | 8.11 |
| Public Service of Colorado | 96 | (92.92) | 69 | -5.13 | 46 | 2.24 | 0.06 | 1.14 | 0.13 | 22.375 | 16.000 | -10.02 |
| Consumers Power | 97 | NA | 85 | -7.95 | 52 | 1.76 | 0.16 | -0.85 | 0.74 | 17.375 | 7.500 | -9.04 |
| Northern Indiana Public Service | 98 | NA | 97 | -14.80 | 91 | -6.92 | -0.29 | -0.12 | (0.57) | 13.500 | 9.375 | 2.72 |
| Public Service of New Hampshire | 99 | NA | 60 | -2.80 | 66 | -0.60 | -1.70 | 0.94 | (8.44) | 11.375 | 7.375 | 23.34 |
| Centel | 100 | NA | 79 | -6.32 | 72 | -1.30 | NA | NA | NA | NA | NA | NA |

| Company | Electric Sales (KWH) (millions) | Rank | Customers Served: Electric Total | Electric % Gain | Gas Total | Gas % Gain | Revenues: Total $ (1000's) | Revenues: % Electric | Revenues: % Gas | Net Income After Tax $ (1000's) |
|---|---|---|---|---|---|---|---|---|---|---|
| Allegheny Power System | 41,171 | 13 | 1,206,558 | 1.46 | 0 | 0.00 | 1,704,093 | 100.00 | 0.00 | 203,746 |
| American Electric Power | 101,584 | 2 | 2,616,952 | 1.16 | 75,578 | 2.52 | 4,842,801 | 98.91 | 1.77 | 507,171 |
| Atlantic Energy | 6,521 | 74 | 407,776 | 3.18 | 0 | 0.00 | 582,961 | 100.00 | 0.00 | 63,923 |
| AZP Group | 13,863 | 46 | 545,018 | 4.50 | 0 | 0.00 | 1,249,915 | 100.00 | 0.00 | 234,184 |
| Baltimore Gas & Electric | 21,236 | 31 | 942,314 | 2.80 | 518,279 | 0.36 | 1,834,020 | 75.69 | 24.31 | 247,743 |
| Boston Edison | 13,508 | 49 | 644,138 | 1.25 | 0 | 0.00 | 1,105,367 | 97.93 | 0.00 | 92,299 |
| Carolina Power & Light | 34,561 | 16 | 885,759 | 3.85 | 0 | 0.00 | 2,040,798 | 100.00 | 0.00 | 312,950 |
| Centel | 2,885 | 95 | 135,590 | 0.19 | 0 | 0.00 | 170,894 | 99.19 | 0.00 | NA |
| Centerior Energy | 25,326 | 26 | 998,542 | 0.64 | 0 | 0.00 | 1,917,730 | 99.55 | 0.00 | 391,893 |
| Central & South West | 45,777 | 12 | 1,518,300 | 0.21 | 0 | 0.00 | 2,555,102 | 97.38 | 2.62 | 355,193 |
| Central Hudson Gas & Electric | 4,954 | 80 | 236,803 | 2.70 | 53,055 | 4.85 | 436,551 | 85.99 | 14.01 | 59,270 |
| Central Illinois Light | 4,427 | 84 | 182,279 | 0.43 | 183,616 | 0.74 | 489,621 | 61.04 | 36.46 | 49,831 |
| Central Illinois Public Service | 7,508 | 67 | 305,272 | −0.09 | 156,258 | 0.07 | 626,361 | 80.66 | 19.34 | 67,007 |
| Central Louisiana Electric | 5,129 | 78 | 196,455 | 0.42 | 0 | 0.00 | 297,133 | 100.00 | 0.00 | 39,010 |
| Central Maine Power | 8,138 | 65 | 443,637 | 2.90 | 0 | 0.00 | 508,809 | 100.00 | 0.00 | 35,012 |
| Central Vermont Public Service | 2,648 | 96 | 126,426 | 2.52 | 0 | 0.00 | 190,810 | 98.15 | 0.00 | 23,470 |
| Cincinnati Gas & Electric | 16,437 | 41 | 632,356 | 1.58 | 371,995 | 0.69 | 1,403,478 | 70.34 | 29.66 | 150,324 |
| Commonwealth Edison | 65,117 | 4 | 3,060,046 | 1.06 | 0 | 0.00 | 5,478,511 | 100.00 | 0.00 | 932,941 |
| Commonwealth Energy System | 5,997 | 77 | 320,000 | 1.91 | 211,000 | 1.44 | 612,940 | 61.00 | 37.22 | 38,093 |
| Consolidated Edison | 30,167 | 20 | 2,846,094 | 0.94 | 1,022,177 | −0.11 | 5,197,736 | 81.31 | 13.38 | 508,330 |
| Consumers Power | 27,160 | 25 | 1,400,000 | 1.45 | 1,250,000 | 2.46 | 3,108,414 | 57.13 | 41 41 | 66,052 |
| Delmarva Power & Light | 9,206 | 59 | 329,911 | 3.59 | 77,551 | 2.88 | 714,883 | 84.25 | 12.84 | 88,718 |
| Detroit Edison | 38,040 | 14 | 1,817,493 | 1.42 | 0 | 0.00 | 2,869,284 | 98.73 | 0.00 | 378,292 |
| Dominion Resources | 49,660 | 11 | 1,615,700 | 4.12 | 133,378 | 4.36 | 3,071,600 | 94.06 | 3.60 | 379,800 |
| DPL, Inc. | 11,611 | 52 | 429,706 | 1.09 | 267,563 | 0.76 | 963,649 | 72.94 | 26.27 | 125,895 |
| Duke Power | 60,513 | 6 | 1,483,090 | 3.03 | 0 | 0.00 | 3,400,933 | 97.90 | 0.00 | 409,067 |
| Duquesne Light | 12,650 | 50 | 563,196 | 0.29 | 0 | 0.00 | 896,263 | 100.00 | 0.00 | 130,879 |
| Eastern Utilities Associates | 3,760 | 90 | 244,000 | 0.00 | 0 | 0.00 | 343,324 | 100.00 | 0.00 | 32,490 |
| El Paso Electric | 4,491 | 82 | 220,465 | 3.55 | 0 | 0.00 | 318,109 | 99.32 | 0.00 | 81,429 |
| Empire District Electric | 2,923 | 93 | 109,563 | 2.14 | 0 | 0.00 | 133,490 | 99.57 | 0.00 | 15,265 |
| Florida Progress | 23,170 | 29 | 1,009,441 | 4.28 | 0 | 0.00 | 1,874,700 | 81.64 | 0.00 | 181,200 |
| FPL Group | 54,276 | 9 | 2,791,475 | 4.22 | 0 | 0.00 | 4,091,504 | 100.00 | 0.00 | 365,411 |
| General Public Utilities | 34,770 | 15 | 1,742,276 | 2.61 | 0 | 0.00 | 2,787,077 | 99.92 | 0.00 | 205,247 |
| Gulf States Utilities | 24,805 | 28 | 555,075 | −0.25 | 83,994 | −1.23 | 1,478,368 | 92.50 | 2.24 | 181,854 |
| Hawaiian Electric Industries | 6,754 | 70 | 314,805 | 2.05 | 0 | 0.00 | 558,059 | 94.23 | 0.00 | 43,092 |
| Houston Industries | 54,008 | 10 | 1,303,205 | −1.00 | 0 | 0.00 | 3,535,966 | 83.70 | 2.96 | 424,935 |
| Idaho Power | 13,668 | 48 | 274,144 | 0.73 | 0 | 0.00 | 408,861 | 100.00 | 0.00 | 67,880 |
| IE Industries | 4,344 | 85 | 206,007 | 0.02 | 126,951 | −4.54 | 429,245 | 66.50 | 29.16 | 28,536 |
| Illinois Power | 15,235 | 44 | 540,595 | 0.66 | 383,201 | 0.20 | 1,183,865 | 68.77 | 31.23 | 256,479 |
| Interstate Power | 3,889 | 89 | 155,754 | 0.00 | 45,235 | 0.04 | 294,112 | 71.99 | 28.01 | 16,770 |
| Iowa-Illinois Gas & Electric | 4,124 | 86 | 170,527 | 7.32 | 206,771 | 0.00 | 538,382 | 52.47 | 47.53 | 52,385 |
| Iowa Resources | 5,001 | 79 | 239,839 | 1.24 | 0 | 0.00 | 336,490 | 98.50 | 0.00 | 43,781 |
| Iowa Southern Utilities | 1,811 | 99 | 93,499 | 0.25 | 37,719 | 0.03 | 138,742 | 73.34 | 26.66 | 15,719 |
| Ipalco | 10,321 | 56 | 357,236 | 2.22 | 0 | 0.00 | 512,446 | 94.80 | 0.00 | 122,723 |
| Kansas City Power & Light | 9,324 | 58 | 385,006 | 3.08 | 0 | 0.00 | 664,870 | 98.42 | 0.00 | 86,495 |
| Kansas Gas & Electric | 7,577 | 66 | 247,726 | 0.69 | 0 | 0.00 | 496,340 | 98.61 | 0.00 | 58,698 |
| Kansas Power & Light | 9,152 | 60 | 294,181 | 0.98 | 1,032,591 | 1.39 | 1,198,884 | 40.28 | 59.72 | 83,749 |
| Kentucky Utilities | 11,609 | 53 | 390,700 | 1.59 | 0 | 0.00 | 550,859 | 100.00 | 0.00 | 53,907 |
| Long Island Lighting | 14,637 | 45 | 963,191 | 1.52 | 410,064 | 1.17 | 1,977,121 | 80.79 | 18.48 | 252,864 |
| Louisville Gas & Electric | 8,437 | 64 | 309,670 | 1.21 | 236,211 | 0.82 | 885,226 | 70.83 | 28.53 | 63,801 |
| Madison Gas & Electric | 2,022 | 98 | 106,250 | 1.73 | 76,559 | 3.84 | 210,347 | 59.35 | 40.25 | 18,696 |
| MDU Resources Group | 1,807 | 100 | 111,373 | −1.52 | 176,121 | −0.55 | 305,412 | 38.08 | 61.92 | 14,216 |
| Middle South Utilities | 57,807 | 8 | 1,670,430 | 0.62 | 227,612 | −0.93 | 3,485,912 | 95.79 | 4.21 | 451,302 |
| Midwest Energy | 2,942 | 92 | 155,048 | −0.84 | 330,620 | 176.23 | 592,591 | 37.15 | 54.95 | 34,780 |
| Minnesota Power | 7,437 | 68 | 116,003 | 0.33 | 8,769 | 0.56 | 395,469 | 90.92 | 2.42 | 75,993 |
| Montana Power | 9,826 | 57 | 244,749 | 0.56 | 104,789 | 1.00 | 655,419 | 53.15 | 15.06 | 82,474 |
| Nevada Power | 6,709 | 72 | 250,256 | 6.40 | 0 | 0.00 | 383,405 | 100.00 | 0.00 | 43,712 |
| New England Electric | 19,574 | 33 | 1,175,307 | 2.43 | 0 | 0.00 | 1,431,943 | 94.07 | 0.00 | 171,996 |
| New York State Electric & Gas | 15,352 | 43 | 716,601 | 1.79 | 133,542 | 1.24 | 1,277,284 | 85.97 | 14.03 | 208,390 |
| Niagara Mohawk Power | 34,347 | 17 | 1,443,000 | 2.05 | 445,000 | 1.14 | 2,660,319 | 80.13 | 19.87 | 344,048 |
| Northeast Utilities | 22,482 | 30 | 1,177,510 | 2.46 | 165,443 | 2.35 | 2,032,117 | 87.74 | 10.03 | 300,894 |
| Northern Indiana Public Service | 11,136 | 55 | 364,692 | 0.53 | 554,383 | 1.85 | 1,626,127 | 54.43 | 45.57 | (41,385) |
| Northern States Power | 29,627 | 21 | 1,231,760 | 1.44 | 315,190 | 2.34 | 1,781,630 | 80.14 | 19.30 | 193,343 |
| Ohio Edison | 28,166 | 24 | 994,588 | 0.76 | 0 | 0.00 | 1,741,900 | 98.55 | 0.00 | 359,825 |
| Oklahoma Gas & Electric | 18,400 | 36 | 639,333 | −0.96 | 0 | 0.00 | 1,090,872 | 100.00 | 0.00 | 119,051 |
| Orange & Rockland Utilities | 3,981 | 88 | 229,545 | 2.53 | 97,774 | 2.49 | 474,664 | 72.88 | 26.38 | 36,703 |
| Otter Tail Power | 3,018 | 91 | 121,232 | −0.52 | 0 | 0.00 | 172,221 | 100.00 | 0.00 | 21,326 |
| Pacific Gas & Electric | 58,207 | 7 | 3,854,787 | 2.51 | 3,158,426 | 2.45 | 7,816,661 | 71.23 | 28.77 | 925,033 |
| Pacificorp | 24,809 | 27 | 662,928 | 0.37 | 0 | 0.00 | 2,066,900 | 51.87 | 0.00 | 230,700 |
| Pennsylvania Power & Light | 30,425 | 19 | 1,073,146 | 1.67 | 0 | 0.00 | 2,188,925 | 100.00 | 0.00 | 231,051 |
| Philadelphia Electric | 28,963 | 22 | 1,396,693 | 1.51 | 316,484 | 2.17 | 3,141,936 | 85.91 | 12.46 | 475,359 |
| Portland General Electric | 17,582 | 39 | 535,011 | 2.07 | 0 | 0.00 | 759,843 | 100.00 | 0.00 | 15,830 |
| Potomac Electric Power | 20,762 | 32 | 593,091 | 2.19 | 0 | 0.00 | 1,370,542 | 98.93 | 0.00 | 194,220 |
| Public Service Enterprise Group | 33,299 | 18 | 1,778,227 | 1.18 | 1,385,299 | 1.50 | 4,498,416 | 70.16 | 29.45 | 378,463 |
| Public Service of Colorado | 17,928 | 37 | 958,037 | 1.77 | 819,742 | 3.17 | 1,657,863 | 63.07 | 35.99 | 6,666 |
| Public Service of Indiana | 18,403 | 35 | 559,628 | 0.98 | 0 | 0.00 | 1,049,094 | 98.29 | 0.00 | (50,618) |
| Public Service of New Hampshire | 7,028 | 69 | 342,414 | 6.12 | 0 | 0.00 | 505,190 | 96.92 | 0.00 | (239,346) |
| Public Service of New Mexico | 6,728 | 71 | 267,128 | 4.68 | 322,335 | 2.33 | 697,995 | 63.48 | 35.05 | 132,818 |
| Puget Sound Power & Light | 16,218 | 42 | 646,253 | 3.45 | 0 | 0.00 | 714,763 | 100.00 | 0.00 | 110,248 |
| Rochester Gas & Electric | 6,702 | 73 | 312,129 | 1.49 | 245,446 | 1.81 | 748,649 | 65.05 | 34.95 | 104,519 |
| San Diego Gas & Electric | 11,725 | 51 | 940,752 | 5.25 | 594,874 | 4.22 | 1,634,211 | 81.69 | 18.31 | 190,771 |
| Savannah Electric & Power | 2,376 | 97 | 102,154 | 2.31 | 0 | 0.00 | 175,585 | 99.45 | 0.00 | 20,452 |
| Scana Corp. | 4,014 | 87 | 209,300 | 3.27 | 64,459 | 5.81 | 373,154 | 81.43 | 11.65 | 35,518 |
| Sierra Pacific Resources | 13,704 | 47 | 406,511 | 3.23 | 192,941 | 1.02 | 1,102,036 | 73.45 | 26.26 | 122,164 |
| Southern California Edison | 64,197 | 5 | 3,589,414 | 2.84 | 1,209 | −0.17 | 5,313,336 | 99.97 | 0.01 | 713,933 |
| Southern Company | 123,412 | 1 | 2,955,844 | 2.61 | 0 | 0.00 | 6,846,591 | 99.15 | 0.00 | 882,860 |
| Southern Indiana Gas & Electric | 4,459 | 83 | 110,543 | 1.83 | 66,697 | 1.85 | 268,645 | 80.17 | 19.83 | 30,065 |
| Southwestern Public Service | 16,463 | 40 | 348,549 | −0.25 | 0 | 0.00 | 808,257 | 99.58 | 0.00 | 112,307 |
| Teco Energy | 11,295 | 54 | 418,082 | 4.18 | 0 | 0.00 | 901,909 | 94.48 | 0.00 | 97,600 |
| Texas Utilities | 75,255 | 3 | 2,074,766 | 2.96 | 0 | 0.00 | 3,932,045 | 100.00 | 0.00 | 626,851 |
| TNP Enterprises | 6,475 | 75 | 196,079 | 1.12 | 0 | 0.00 | 356,293 | 100.00 | 0.00 | 14,223 |
| Tucson Electric Power | 6,212 | 76 | 245,175 | 4.52 | 0 | 0.00 | 425,355 | 100.00 | 0.00 | 112,304 |
| Union Electric | 28,257 | 23 | 1,035,697 | 1.67 | 107,203 | 0.14 | 1,807,182 | 95.32 | 4.48 | 294,648 |
| United Illuminating | 4,913 | 81 | 296,484 | 1.41 | 0 | 0.00 | 471,119 | 99.47 | 0.00 | 82,581 |
| Utah Power & Light | 17,882 | 38 | 516,362 | 1.89 | 0 | 0.00 | 984,885 | 99.87 | 0.00 | 84,200 |
| Utilicorp United | 2,867 | 94 | 149,462 | 3.31 | 384,099 | 6.81 | 595,805 | 32.32 | 67.68 | 25,892 |
| Washington Water Power | 8,677 | 62 | 240,000 | 0.84 | 83,000 | 3.75 | 389,867 | 77.61 | 21.96 | 62,414 |
| Wisconsin Electric Power | 18,963 | 34 | 847,761 | 1.06 | 235,719 | 2.59 | 1,411,143 | 79.46 | 19.70 | 157,742 |
| Wisconsin Energy | 8,715 | 61 | 323,085 | 1.15 | 112,042 | 2.39 | 589,248 | 76.77 | 22.52 | 58,670 |
| Wisconsin Public Service | 9,466 | 63 | 307,569 | 1.82 | 162,913 | 2.06 | 592,270 | 69.31 | 30.69 | 47,149 |



| Rank '86 | Rank '85 | Company | Income (millions) | '86 % Change |
|---|---|---|---|---|
| 1 | 2 | Commonwealth Edison | 932.9 | 11.1 |
| 2 | 1 | Pacific Gas & Electric | 925.0 | 6.6 |
| 3 | 3 | Southern Company | 882.9 | 6.4 |
| 4 | 4 | Southern California Edison | 713.9 | 1.6 |
| 5 | 5 | Texas Utilities | 626.9 | 6.7 |
| 6 | 6 | Consolidated Edison | 508.3 | −3.2 |
| 7 | 11 | American Electric Power | 507.2 | 21.1 |
| 8 | 10 | Philadelphia Electric | 475.4 | 9.4 |
| 9 | 12 | Middle South Utilities | 451.3 | 12.8 |
| 10 | 8 | Houston Industries | 424.9 | −2.1 |

**Top 100 Electric Utilities**

## Name changes

(Holding company name is in **boldface**)

| | |
|---|---|
| **Atlantic Energy Inc.** | Atlantic Electric |
| **Centerior Energy** | Cleveland Electric and Toledo Edison |
| **Dominion Resources** | Virginia Power |
| **DPL, Inc.** | Dayton Power & Light |
| **Florida Progress** | Florida Power |
| **FPL Group** | Florida Power & Light |
| **Hawaiian Electric Industries** | Hawaiian Electric |
| **Houston Industries** | Houston L & P |
| **IE Industries** | Iowa Electric L&P |
| **Iowa Resources** | Iowa P&L |
| **IPALCo** | Indianapolis P&L |
| **MDU Resources** | Montana-Dakota Utils |
| **Pacificorp** | Pacific P&L |
| **Pinnacle West Capital** | AZP Group |
| **Public Service Enterprise Gp** | Public Service Electric & Gas |
| **SCANA Corp** | South Carolina E&G |
| **TECo** | Tampa Electric |
| **TNP Enterprises** | Tex-NM Power |
| **Utilicorp United** | Missouri P.S. |
| **Wisconsin Energy** | Wisconsin Electric |

on data provided by 99 utilities. Centel did not provide financial data.

The improvement in EPS performance reflects both the higher level of net income produced and the larger number of shares over which the income had to be spread.

For 1986, 58 utilities reported improvements from 1985 and 41 reported reductions in earnings. One utility, Consolidated Edison, reported the same earnings as in 1985. A year ago, 51 utilities reported gains, 46 said their per-share earnings fell and two reported the same earnings. For 1984, 72 companies reported EPS gains and in 1983 the number of gainers was 82. Thus, the number of companies posting gains has steadily decreased since 1983.

Median growth was up in 1986, to 1.56 percent, certainly better than 1985's 0.45 percent but well-below the 6.41 percent recorded in 1984, 9.63 percent in 1983 and 10.32 percent in 1982.

### Recovering

As is usual in ratings based on degree of change, the majority of top performers this year were recovering from a poor year in 1985. In fact, the only utility to remain among the top performers in 1986 from 1985 was Minnesota Power, *EL&P's* Electric Utility of the Year for 1986, ranking 10th in 1986 after being 9th in 1985.

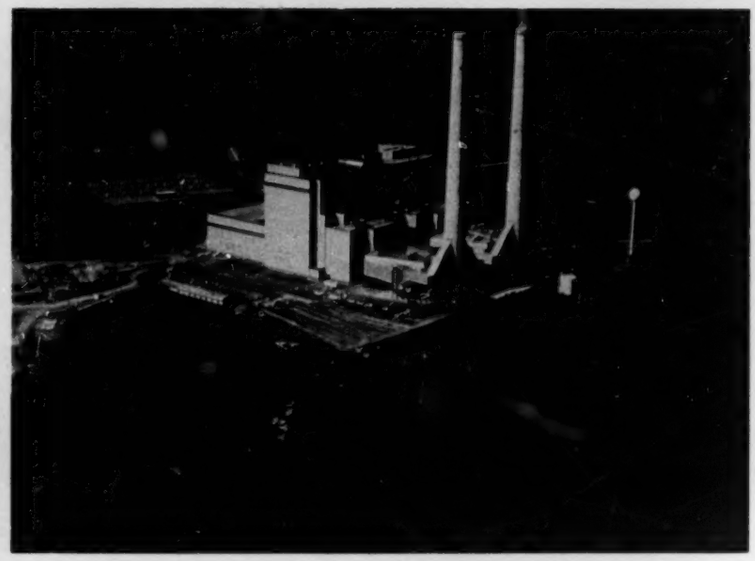
8/13/87 C6985-6

Volume 65, Number 8
August 1987

# Electric Light & Power

THE NEWS MAGAZINE OF ELECTRIC UTILITY MANAGEMENT AND TECHNOLOGY

A PENNWELL PUBLICATION



## *Duke Power's Belews Creek-2 ranks as most efficient unit*

Duke Power Company's Belews Creek Unit 2 (at left) was the most efficient fossil-fueled generating unit in the nation in 1986. The unit had a heat rate of 8,913 Btu per kilowatt hour. The utility had six of the top 11 most efficient units in the country, and had the best system heat rate for fossil-fired boilers. To learn the nation's most efficient investor-owned utility and find out where your company ranks, turn to EL&P's Annual Top 100 Operating Performance Report beginning on p.19.

## Centerior Energy to sell unit ownership for $1 billion

CLEVELAND—Centerior Energy Corporation announced a refinancing package in June that involves a $1 billion sale and leaseback of Toledo Edison's and Cleveland Electric Illuminating's shares of the Bruce Mansfield coal plant and a portion of the companies' shares of the Beaver Valley 2 nuclear unit.

### Rate requests

Centerior Energy, which serves as the parent company for the two utilities, said the plan will enable Edison and CEI to reduce future rate increase requests by at least $35 million a year. No buyers for the generating capacity have yet been found, but a company spokesman said Centerior hoped to have investors lined up before fall. Both plants are located in western Pennsylvania.

The utilities plan to sell all or most of their Mansfield capacity, which totals 764 MW (32%) of the three-unit plant operated by Pennsylvania Power Company.

### Companies' shares

The companies' shares of Beaver Valley 2 total 370 MW (44%). The plant is operated by Duquesne Light Company.

### Beneficial transaction

Centerior pointed out that the transaction will be beneficial from a rate-making standpoint, because it will minimize the effect of placing the companies' newest nuclear units—Perry 1 and Beaver Valley 2 in rate base.

Beaver Valley 2 recently won Nuclear Regulatory Commission approval to load fuel and conduct low power testing of the unit.

### Creative plan

"This is a creative plan that will have a positive effect on our customers and shareowners alike," said Centerior's Senior Vice President-Finance Edgar H. Maugans. "It's the culmination of six months of extremely complex and difficult work by our financial people, and it's a major step toward achieving long-term financial stability."

The sale and leaseback has recently grown in popularity with utilities that are placing costly new generation in

Continued on page 3

Cor
**********5-DIGIT 20814
410012730Z*080187T 000000*
0021
SUITE 800 COPY # 1 80147
CONGRESSIONAL INFO SERVICES
4520 EAST WEST HWY
BETHESDA MD 20814

## EPRI utility survey identifies major areas of future concern

PALO ALTO, CA—Future power supply, cost and finance concerns, the environment and utility competition are some of the primary issues facing electric utilities, according to the Electric Power Research Institute's Ninth Member Utility Survey. (See chart.)

EPRI compiled survey responses from 109 of the 548 EPRI member utilities. The institute said it uses the results of the poll to aid in preparing its strategic plan.

### Power supply important

The survey found that future power supply is seen by the members as a very important long-term issue. Concerns related to power supply, such as reducing costs, environmental worries and end use were viewed as having high potential resolution through research, development and demonstration (RD&D).

Issues like finance, deregulation, competition and nuclear plant licensing were seen as having a low potential to be resolved through RD&D.

As for utility RD&D needs, the survey respondents identified clean coal, environmental control, demand-side planning, utility planning methods, system interconnections and operations and acid rain.

### Future demand plans

Most of the companies said they plan to meet future electricity demand primarily from existing generation, life extension and purchasing power from other utilities. (See chart on p.7).

Questioned about their investment

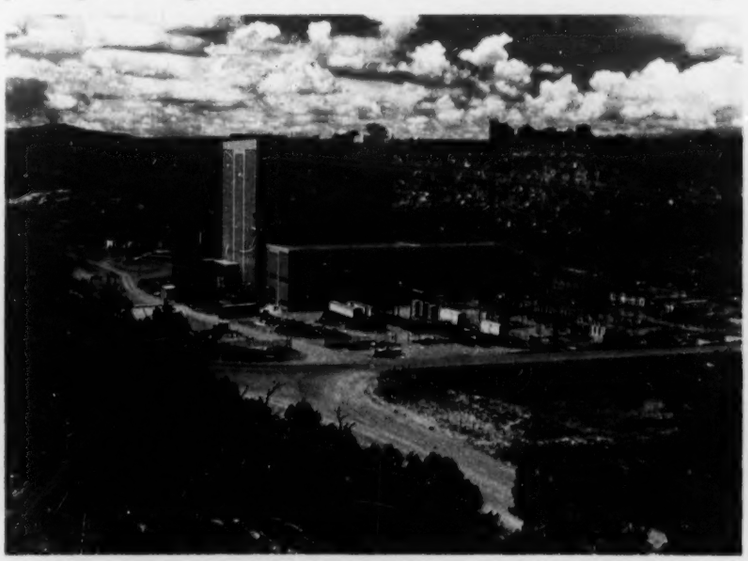
Continued on page 7

**SIGNIFICANT CURRENT UTILITY ISSUES**

| Category | Percent of First-Order Responses |
|---|---|
| Cost and Finance | 21 |
| Power Supply and Resources | 19 |
| End Use and Marketing | 17 |
| Environment | 12 |
| Competition and Deregulation | 11 |
| Transmission and Distribution | 6 |
| Regulatory | 4 |
| Planning | 3 |
| Other: | 7 |
| | 100 |
| Public Relations | |
| Theft | |
| Corporate Culture | |
| Education | |
| Etc. | |

*(Source: Ninth EPRI Member Utility Survey, May 1987)*

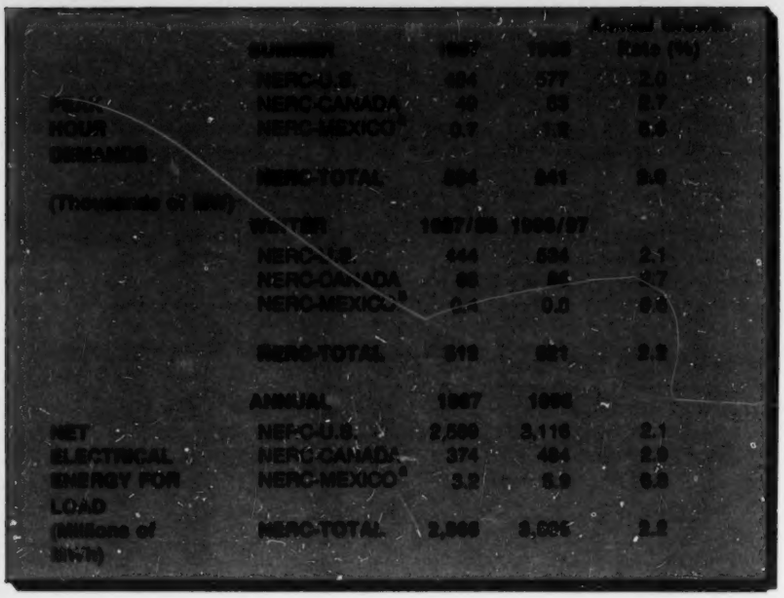
## *Colorado-Ute's utility-scale CFB project generates first electricity*



Colorado-Ute Electric Association's 110 MW Nucla circulating fluidized-bed combustion plant began producing power in June. The utility says the $100 million plant is the first utility-scale power plant using CFB technology. Major retrofitting of the 27-year-old plant began in May 1985. "The CFB technology we are using at Nucla station has great significance for the electric industry and for our customers," said Ted Rosiak, Colorado-Ute's vice president in charge of thermal generation. "Perhaps the single most important characteristic of the plant's technology is the promise it holds as a long-term, cost-effective solution to the acid rain issue." The Nucla demonstration project is being funded by 23 organizations, with no government support.

## SUMMARY OF 1987-1996 NERC PROJECTIONS

**DEMAND**



**SUPPLY**

| | | | | Annual Growth |
|---|---|---|---|---|
| | **SUMMER** | **1987** | **1996** | **Rate (%)** |
| | NERC-U.S. | 647 | 716 | 1.1 |
| | NERC-CANADA | 86 | 97 | 1.4 |
| **PLANNED CAPACITY RESOURCES (Thousands of MW)** | NERC-MEXICO[a] | 0.8 | 1.2 | 4.5 |
| | **NERC-TOTAL** | **734** | **814** | **1.2** |
| | **WINTER** | **1987/88** | **1996/97** | |
| | NERC-U.S. | 668 | 727 | 1.0 |
| | NERC-CANADA | 87 | 101 | 1.5 |
| | NERC-MEXICO[a] | 0.8 | 1.2 | 4.5 |
| | **NERC-TOTAL** | **756** | **829** | **1.0** |

[a] *Includes only that part of the Comision Federal de Electricidad system in the northern portion of Baja California, Mexico, which is interconnected with the U.S. systems.*

*(Source: "1987 Electricity Supply & Demand", North American Electric Reliability Council)*

# NERC issues peak projections

According to the North American Electric Reliability Council, there are no major differences in its latest projections compared to those made in 1986. NERC said growth rates for peak demand and annual energy are slightly lower than those made a year earlier. To serve anticipated demands, NERC said utility systems are planning to increase their net capacity resources by about 80,000 MW over the 1987-1996 period, an average annual growth rate of 1.2 percent. The information comes from an advance release of NERC's annual Electricity Supply & Demand report. A more detailed version of the report will be published later this summer.

# Boston Edison wants to cut large customer demand by 20 percent

BOSTON—Boston Edison launched an ambitious energy conservation and load management program in June that has been designed to reduce by 20 percent the energy consumption and on-peak demand of its 1,500 largest customers.

Under its "Design Plus" program, the utility is encouraging its largest commercial and industrial customers to permit design teams to evaluate their electrical use and propose state-of-the-art equipment and systems aimed at reducing the demand for electricity.

Boston Edison will subsidize the design costs and up to half of the installation costs to retrofit the latest technologies in energy-efficient lighting, HVAC, control and other electric systems over the next three years.

### Ten customers

Ten of the company's eligible customers will be asked to participate in the initial phase of the program this year. The remaining eligible customers will be invited to participate on a first-come-first-serve basis between 1988 and the end of 1990 and will be notified of their eligibility by Dec. 31 of this year.

### Sensational

"We think this is a sensational way to save energy and help our customers enhance the value of their facilities," said Craig Peffer, Boston Edison vice president, commercial. "It's a program that's sure to grab the attention of our biggest customers."

According to the utility, the first 10 customers will provide an estimated total demand savings of slightly more that 2 MW and an annual savings of nearly 8,500 megawatthours.

Boston Edison said customer benefits will include design and contract administration services, up to 50 percent of hardware and installation costs, the latest advances in energy efficient technologies and substantial savings in their electric bills.

# Oglethorpe to take over project

ATLANTA—The managements of Georgia Power Company and Oglethorpe Power Corporation have agreed in principle to form a joint venture covering the ownership and and operation of the partially completed 847-MW Rocky Mountain pumped storage hydro project.

Under the agreement, Oglethorpe would assume construction and operation responsibilities and would own approximately 74 percent of the facility. The exact ownership shares would be determined based on Oglethorpe's cost of completing the plant, compared with Georgia Power's investment prior to the closing.

Construction of the facility was launched in 1978, but nine years later it still is only 15 percent complete.

F.F. Stacy, Oglethorpe president and chief executive officer, estimated that between $600- and $700-million will be required to complete the project. Completion currently is set for 1996.

Robert W. Scherer, Georgia Power chairman, cited the agreement as "another example of the state's power suppliers working together to benefit electric consumers.

"We view the proposed agreement as a continuation of our efforts to ensure a reliable supply of electricity for Georgia's future." Georgia Power and Oglethorpe have cooperated with each other since 1975.

Stacy praised the proposed agreement as being mutually beneficial and said it will provide peak electric power to Oglethorpe's 39 rural cooperatives during a period of great anticipated need. He said that the co-ops' peak demand is expected to grow by about four percent annually over the next ten years.

Although managements of both organizations have signed the letter of intent, a final agreement still must be developed and approved by their boards of directors. Further, regulatory approval will be required.

Once the agreement is reached Oglethorpe Power could begin to assume responsibility for the completion of the facility.

# Centerior Energy to sell . . . from page 1

service. (See chart.)

### Cost-cutting measures

Since merging one year ago, the companies have implemented a series of cost-cutting measures. The utilities will save $25 million annually through an early retirement program. Savings from combining operations functions will total $20 million per year.

Maugans said these and other cost efficiencies made possible by the affiliation are now expected to surpass the $90 million in annual savings anticipated at the time of the affiliation.

## MAJOR SALE-LEASEBACK TRANSACTIONS

| Buyer | Seller and Plant Involved | Price |
|---|---|---|
| Not yet determined | Centerior Energy Corporation (Bruce Mansfield coal plant and Beaver Valley 2 nuclear unit)* | $1 billion (approximate) |
| Emerson Electric, IBM, Philip Morris | Tucson Electric Power Co. (Springerville coal plant) | $850 million |
| Shell Leasing | Deseret Generation (Bonanza coal plant) | $664 million |
| Beatrice Financing Services, Chrysler Financial, Dart & Kraft Financial, First Chicago Leasing, J.C. Penney, Saks | Basin Electric Power Cooperative (Antelope Valley coal station unit 2) | $623 million |
| Group of Investors (Owner Trustee, First National Bank of Boston) | Ohio Edison (Perry nuclear plant unit 1) | $509 million |
| Public offering | El Paso Electric (Palo Verde nuclear plant) | $396 million |
| Chrysler Financial, Ford Motor Credit, HEI Investment, IBM | Oglethorpe Power (Scherer coal plant unit 2) | $395 million |
| Chrysler Capital, Drexel Burnham Leasing, Mellon Financial Services | Public Service of New Mexico (Palo Verde nuclear plant unit 1) | $325 million |
| Drexel Burnham Leasing, General Electric Credit, Shell Leasing | Montana Power (Colstrip coal plant unit 4) | $292 million |
| General Electric Credit | Portland General Electric (Boardman coal plant) | $233 million |

* *Two-part transaction*

*Sources: Business Week, Public Utilities Fortnightly, The Wall Street Journal, Centerior Energy Corporation.*

# Nader group offers nuclear shutdown strategies

WASHINGTON—Public Citizen, the consumer and environmental organization founded by Ralph Nader, has released a report outlining strategies for citizen groups to use in their efforts to close nuclear power plants.

Entitled *Shutdown Strategies: Citizen Efforts to Close Nuclear Power Plants*, the report cites several citizen efforts aimed at closing commercial nuclear reactors.

Public Citizen said citizens are becoming more assertive at the state and local levels as they attempt to have plants closed for economic, safety, environmental and health reasons.

"Growing evidence that a Chernobyl-scale accident could happen in the U.S., the increasing accumulation of radioactive waste that nobody wants, and rate shock that consumers cannot afford, have prompted a resurgence of grass roots activism against nuclear power," said the report's author Joseph Kriesberg.

The report cites state ballot measures pending that could result in the shutdown of the Maine Yankee plant, Rancho Seco plant, the Pilgrim and Rowe units, and the Trojan reactor.

In addition to offering examples of current efforts to close plants, the report reviews eight strategies being used by nuclear activists. They are:

1.) requesting a formal analysis of the economic impact of closing a particular reactor;
2.) intervening before state public utility commissions;
3.) advocating state least-cost electrical planning;
4.) translating concern over nuclear waste into support for closing reactors;
5.) opposing inadequate emergency evacuation planning;
6.) increasing state and local regulatory authority over nuclear safety;
7.) organizing ballot measure campaigns; and
8.) pushing for public power systems.

For each strategy, Public Citizen includes four to nine case studies which summarize efforts at particular plants where that strategy has been or is being used. One or more contact names are also listed in the report.

Copies of the report are available for $25 from Public Citizen, 215 Pennsylvania Ave. SE, Washington, D.C. 20003, (202) 546-4996.

## *Nuclear waste disposal fees "adequate"*

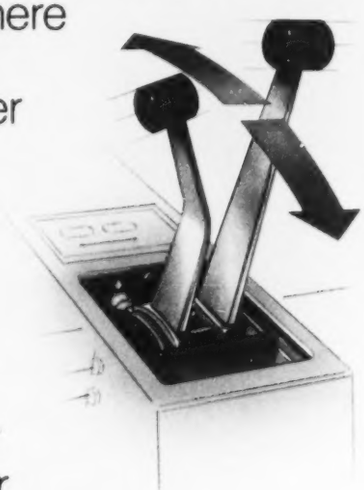
WASHINGTON—The Department of Energy says the fee it collects to pay for radioactive waste disposal is adequate and that no change in the rate is needed at this time.

DOE charges nuclear utilities one mill per kWh of nuclear-generated electricity to cover the federal government's costs for developing the disposal system for spent nuclear fuel and high-level radioactive waste.

The estimated cost of the disposal system is between $28.4- and $38.2-billion in 1986 dollars.


It's hard to be productive when you're constantly changing seats.

That's why Case makes trenchers that offer something you won't find anywhere else—single seat operation. A feature that helps you work faster and more effectively.

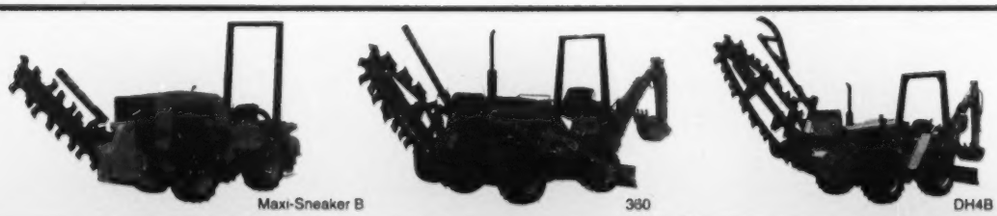


Case's low maintenance, hydrostatic ground drive gives you still another edge. With the single move of a lever, it lets you go from forward to reverse—without clutching—for unmatched productivity in either direction. What's more, you can vary ground speed to accommodate soil conditions. The result: you trench, backfill and plow at peak capacity. All the time.

To learn more about the trenchers that help you do more, visit your Case dealer today.

J I Case
A Tenneco Company
700 State Street Racine, WI 53404 U.S.A.

**Building On Quality™**




case

Inquire R.S. 2


## EPRI survey . . .

from page 1

plans, the respondents said that much of their capital expenditures during the next five years will be spent on finishing plant construction, building new distribution lines, extending plant life and building new transmission substations.

**MEETING DEMAND (Normalized to 100%)**

| Means | 1986-1995 | 1996-2005 |
|---|---|---|
| Existing Generation (includes life extension) | 58% | 48% |
| Buy from other utilities | 28 | 29 |
| New Generation | | |
| Conventional | 4 | 7 |
| Advanced | 1 | 4 |
| Demand-Side Management | 5 | 6 |
| Buy from Cogenerators, etc. | 3 | 4 |
| Uncommitted as yet | 1 | 2 |

*(Source: Ninth EPRI Member Utility Survey, May 1987)*

Cited as likely envirnomental "problem" issues were PCBs, acid rain, hazardous waste disposal, leaking underground storage tanks and transmission right-of-way siting.

### Strategic plan emphasis

EPRI asked the utilities where its strategic program emphasis should be placed. Respondents ranked highest the Environmental Assessment, Environmental Control Technology, and Fossil Fuel Power Plants programs. Demand-side Planning and Distribution strategic programs rose significantly from the previous survey, while Environmental Assessment, Transmission, and Plant Electrical Systems and Equipment strategic programs rose somewhat from the last survey.

### For more information

All the survey results were analyzed on a national and a regional basis. For more information, or a copy of the survey (Special Report P5160-SR), contact EPRI at (415) 855-2000.

# Peak demand periods can be forecast faster and more accurately

Steve R. Shelton
ElectriCities of North Carolina

Keith S. Henry
Southern Engineering

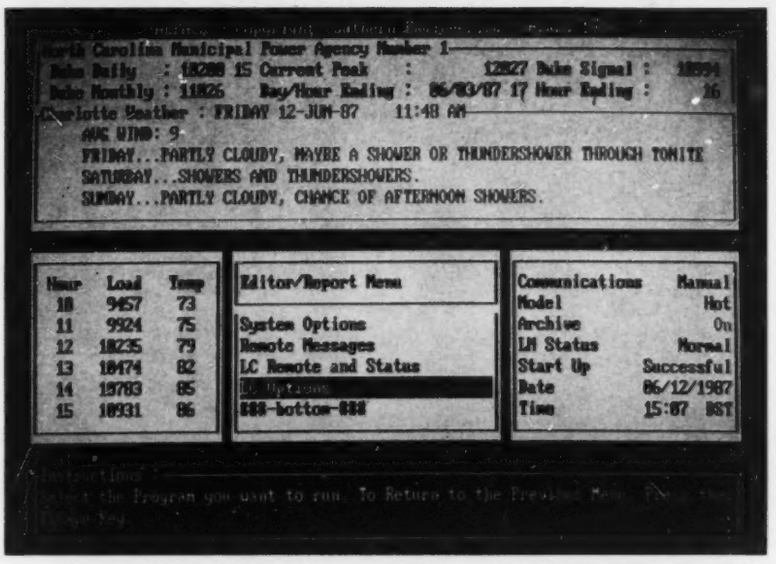
In the rolling hills of piedmont North Carolina, a new load management system is being tested that is enabling those municipal utilities that own and operate their own electric distribution systems to access load management information using personal computers.

The system saves municipalities both time and money by quickly forecasting and communicating peak demand periods.

The load management program is a computer-based information system that helps municipal employees make decisions by providing relevant data in an easily understandable form. The system accesses a database to locate the necessary information, uses mathematical or statistical models, and produces the desired decision-support information at the user's terminal. It can be used as an analytical tool or can be combined with an "expert system" for a more automated operation.

Fifty-one of North Carolina's "electric cities" are participants in two power supply agencies. The power agencies contract for a range of technical and management services through ElectriCities of North Carolina, Inc., a joint municipal assistance agency based in Raleigh.

North Carolina Municipal Power Agency Number 1 (NCMPA 1) serves 19 piedmont North Carolina municipalities, while the North Carolina Eastern Municipal Power Agency (NCEMPA) provides service to 32 eastern North Carolina cities and towns.


Carolina Municipal Power Agency Number 1
Duke Daily : 18200 15 Current Peak : 12827 Duke Signal :
Duke Monthly : 11826 Day/Hour Ending : 06/03/87 17 Hour Ending : 16
Charlotte Weather : FRIDAY 12-JUN-87 11:48 AM
AVG WIND: 9
FRIDAY...PARTLY CLOUDY, MAYBE A SHOWER OR THUNDERSHOWER THROUGH TONITE
SATURDAY...SHOWERS AND THUNDERSHOWERS.
SUNDAY...PARTLY CLOUDY, CHANCE OF AFTERNOON SHOWERS.
Hour Load Temp
10 9457 73
11 9924 75
12 10235 79
13 10474 82
14 10783 85
15 10931 86
Editor/Report Menu
System Options
Remote Messages
LC Remote and Status
Communications Manual
Modem Hot
Archive On
LM Status Normal
Start Up Successful
Date 06/12/1987
Time 15:07 EST

The main screen shows a variety of information, such as previous peak, projected peak, current load, and weather data. Menu is bottom center of screen.

Baseload for NCMPA 1 consumers is supplied by its 75 percent ownership share of Unit 2 of the Catawba Nuclear station constructed by Duke Power Company. NCEMPA has a similar joint ownership arrangement with Carolina Power & Light Company and five generating units.

### Demand charges

Within the NCMPA 1 service area, the demand charges for each municipality are based upon its load during the hour of the Duke system monthly peak. Before July 1983 all 19 cities were on a wholesale rate that contained a 30-minute billing demand for each delivery point.

Now the cities can consolidate their efforts to predict the monthly one hour peak of a much larger system. If the peak hour can be accurately predicted, load management periods can be minimized, resulting in greater load reductions and less customer inconvenience.

NCMPA 1 officials relied on historical data combined with intuitive guesses to determine the monthly peak in the past. The new system produces a more accurate forecast and will allow the cities to access load management information at their convenience.

The agency wanted a system which could collect and maintain data, forecast future hourly loads, display the data in color graphics, and determine the optimal hours to load manage and communicate the information to participating cities. NCMPA 1 could not justify purchasing a centralized SCADA system. So, it contracted with Southern Engineering to build such a system.

It is now completed and six cities are connected to the system. NCMPA 1 anticipates that within the year a total of 10 or 12 of the 19 municipalities will purchase the hardware and begin to use the system.

### Convenient accessing

"The convenience of accessing load forecasting information is valuable in the management of our load control system," said Lloyd Shank, Electric Utility Director of High Point. "The system helps us to make better use of our time and provides us with data that otherwise would have cost us a small fortune to obtain."

NCMPA 1 expects to save more than $1.5 million this year through its load management activities. It plans to concentrate on improving the system by evaluating the model and weather forecasts, determining the accuracy of the analog signal as compared with edited billing data, and by testing different load control parameters in the load control logic.

In addition, access to a weather radar system is being considered in order to track thunderstorms across the service area as they develop. NCEMPA, the sister power agency, is also working to install a similar system for its own use that will soon be in operation.

The new NCMPA 1 system consists

Continued on page 16

# *Summer residential electric bills slightly higher in '86, says survey*

WASHINGTON—The nationwide average cost for electricity last summer for residential customers was 8.3 cents per kilowatt hour, according to a survey taken by the National Association of Regulatory Utility Commissioners.

The survey found that typical summer residential bills in 1986 varied by almost 400 percent depending upon the area of the country. NARUC said customers in Ontario, Oregon paid about 3.9 cents per kWh, while customers in New York City paid 14.8 cents per kWh. (See table.)

NARUC's seventh annual survey contains bill comparisons for the largest service territories of the major investor-owned regulated electric utilities. A total of 194 service areas were surveyed. Bills for residential electric service for the months of June, July and August were reported to NARUC for three different levels of energy consumption—250-kWh, 500-kWh, and 750-kWh. Also reported were typical levels of electricity use for customers with central air conditioning.

### Bills vary little from 1985

According to the organization, the report shows that residential bills have remained virtually unchanged over the bills reported in 1985. Using the 500-kWh per month level as a comparison, NARUC pointed out that the nationwide average cost of electricity rose from 8.2 cents per kWh in 1985 to 8.3 cents per kWh in 1986.

The study shows that in 14 service areas, consumers are paying 11 cents or more per kWh, while in 21 service territories customers pay less than 6 cents per kWh.

Those five companies with the most expensive service territories are: Consolidated Edison, Commonwealth Edison, Long Island Lighting,. Orange & Rockland Utilities, and San Diego Gas & Electric.

Utilities with the least expensive service areas include: Idaho Power (Ontario, OR), Pacific Power & Light, Washington Water Power (Spokane, WA), Washington Water Power (Lewiston, ID), and Idaho Power (Boise, ID).

### For copies

Copies of the 205-pp. report can be obtained for $16.50 each from NARUC, P.O. Box 684, Washington, D.C. 20044.

**TEN MOST EXPENSIVE SERVICE TERRITORIES**

| Company | City | State | 500 KWH Jun | 500 KWH Jul | 500 KWH Aug | Total Bill | Avg. Cost Cents/KWH | Nation Rank |
|---|---|---|---|---|---|---|---|---|
| Consolidated Edison Co. of N.Y. | New York | New York | $74.38 | $75.33 | $72.69 | $222.40 | $0.148 | 1 |
| Commonwealth Edison Co. | Chicago | Illinois | $71.41 | $71.62 | $72.87 | $215.90 | $0.144 | 2 |
| Long Island Lighting Co. | Long Beach | New York | $64.82 | $62.84 | $63.11 | $190.77 | $0.127 | 3 |
| Orange & Rockland Utilities, Inc. | Middletown | New York | $63.54 | $61.47 | $60.04 | $185.05 | $0.123 | 4 |
| San Diego Gas & Electric Co. | San Diego | California | $59.97 | $59.97 | $59.97 | $179.91 | $0.120 | 5 |
| Public Service Elec. & Gas. Co. | Newark | New Jersey | $58.72 | $58.72 | $58.72 | $176.16 | $0.117 | 6 |
| Philadelphia Electric Co. | Philadelphia | Pennsylvania | $57.58 | $58.81 | $58.81 | $175.20 | $0.117 | 7 |
| Iowa-Illinois Gas & Elec. Co. | Rock Island | Illinois | $58.12 | $57.82 | $57.48 | $173.42 | $0.116 | 8 |
| Kauai Electric Co. | Lihue | Hawaii | $60.17 | $56.66 | $54.11 | $170.94 | $0.114 | 9 |
| Hawaii Electric Light Co. | Hilo | Hawaii | $58.33 | $56.86 | $54.42 | $169.61 | $0.113 | 10 |

**TEN LEAST EXPENSIVE SERVICE TERRITORIES**

| Company | City | State | 500 KWH June | 500 KWH Jul | 500 KWH Aug | Total Bill | Avg. Cost Cents/KWH | Nation Rank |
|---|---|---|---|---|---|---|---|---|
| Idaho Power Co. | Ontario | Oregon | $19.26 | $19.26 | $19.26 | $57.78 | $0.039 | 194 |
| Pacific Power & Light Co. | Yakima | Washington | $19.52 | $19.52 | $19.52 | $58.56 | $0.039 | 193 |
| Washington Water Power Co. | Spokane | Washington | $19.99 | $19.99 | $19.99 | $59.97 | $0.040 | 192 |
| Washington Water Power Co. | Lewiston | Idaho | $20.02 | $20.02 | $20.02 | $60.06 | $0.040 | 191 |
| Idaho Power Co. | Boise | Idaho | $20.90 | $20.90 | $20.97 | $62.77 | $0.042 | 190 |
| Montana Power Co. | Billings | Montana | $21.39 | $21.39 | $21.39 | $64.17 | $0.043 | 189 |
| CP National Corp. | La Grande | Oregon | $22.12 | $22.12 | $22.12 | $66.36 | $0.044 | 188 |
| Pacific Power & Light Co. | Kalispell | Montana | $23.35 | $23.35 | $23.37 | $70.07 | $0.047 | 187 |
| Portland General Elec. Co. | Portland | Oregon | $24.12 | $24.12 | $24.12 | $72.36 | $0.048 | 186 |
| Pacific Power & Light Co. | Portland | Oregon | $26.19 | $26.19 | $26.19 | $78.57 | $0.052 | 185 |

*(Source: NARUC 1986 Summer Survey of Residential Electric Bills)*

# THE TOP 100 electric utilities' 1986 operating performances

Don Minner
Associate Editor

Coal usage dropped slightly in 1986... oil usage rose substantially...gas usage was lower...peak demands and reserve margins barely grew...and, generating capacity increased only slightly during the year.

These are some of the highlights of *EL&P's* annual review of 1986 operating data from the nation's 100 largest investor-owned utilities. The information is taken from their Uniform Statistical Reports. Individual utility data are shown on the large tables on the following pages and summaries can be found in the smaller tables.

Fossil fuel consumption changes are highlighted in Table 1. Coal usage for the Top 100 dipped 1.5 percent in 1986 to 509 million tons, from 1985's 517 million tons.

According to the National Coal Association, all U.S. electric utilities are expected to use 694 million tons of coal in 1987. Coal's share of the generation market is predicted to be 55.3 percent, down from its approximate 56 percent share in 1986. It was about 56 percent in 1985, also.

NCA said only 2.1 gigawatts of new coal-fired capacity will come on-line in 1987, compared to 8.8 gigawatts of new nuclear capacity. Overall, forecasts the association, electricity generation is expected to rise 2 percent this year.

Slightly lower growth will be experienced in the traditionally coal-based industrial Midwest and higher growth rates will occur in New England, the South and Southwest. NCA stated these are regions where competing fuels and available nuclear power make a greater difference in the amount of coal used.

Overall, said NCA, U.S. production of bituminous coal and lignite is forecast to reach a record 897 million tons by year-end, 9 million tons more than in 1986 and 1 million tons above the historic high reached in 1984.

### 1986 coal use

Here's how the largest coal users in the Top 100 fared in 1986:

○ Southern Company...down 3 percent to 42.7 million tons.
○ American Electric Power...up 0.4 percent to 41.8 million tons.
○ Texas Utilities...up 8 percent to 31.7 million tons.
○ Detroit Edison...up 2 percent to 15.9 million tons.
○ Allegheny Power...down 5 percent to 14.7 million tons.
○ Commonwealth Edison...down 0 02 percent to 13.6 million tons.
○ Central & South West...down 1 percent to 13.0 million tons.
○ Ohio Edison...down 3 percent to 11.1 million tons.
○ Duke Power...up 9 percent to 11.1 million tons, and
○ Public Service of Indiana...up 2 percent to 10.9 million tons.

The Utility Data Institute, a nonprofit information service company in Washington, D.C., recently noted that U.S. electric utilities added 21 new steam-electric power plants to the national grid in 1986, resulting in 16,441 MW of new capacity. Twenty-one hydroelectric, gas turbine, and diesel units totaling 635 MW also were placed in service.

The new steam capacity included 12 new coal-fired plants (7,072 MW) at a cost of about $7 billion. The units were located in Indiana, Kentucky, Louisiana, Montana, North Dakota, Oklahoma, Texas and Utah.

Eight new nuclear plants (9,314 MW) entered commercial operation in 1986 at a cost of $25 billion, said UDI. The units are located in Arizona, California, Connecticut, Louisiana, New Jersey, Pennsylvania, and South Carolina.

### Oil usage

Reflecting continued low oil prices, the Top 100 increased its oil consumption by almost 26 percent, to 215 million barrels in 1986. The rise in oil usage stopped a trend of decreases in consumption the previous two years. At a meeting of OPEC oil ministers at the end of June, the group announced an agreement to limit production to 16.6 million barrels of oil per day in the second half of 1987. Analysts say this should boost oil prices by at least one dollar by year's end. OPEC desires to keep oil prices at or above the $18 a barrel price level.

Utilities that showed the largest increases in oil consumption last year (among those that burned at least one million barrels in 1986) were:

○ Middle South Utilities...up 846 percent to 2.2 million barrels.
○ Dominion Resources...up 242 percent to 4.8 million barrels.
○ GPU...up 152 percent to 1.7 million barrels.
○ Detroit Edison...up 107 percent to 1.4 million barrels.
○ Niagara Mohawk Power...up 92 percent to 9.6 million barrels, and
○ Public Service of New Hampshire ...up 92 percent to 4.7 million barrels.

Utilities that had the largest decreases in oil consumption last year (among those that burned at least one million barrels) were:

○ San Diego Gas & Electric...down 141 percent to 2.6 million barrels.
○ Eastern Utilities Associates ...down 119 percent to 5.9 million barrels.
○ Southern California Edison...down 42 percent to 1.3 million barrels.
○ Baltimore Gas & Electric...down 29 percent to 1.4 million barrels, and
○ Public Service Enterprise...down 13 percent to 6.2 million barrels.

**TABLE 1**
**FOSSIL FUEL CONSUMPTION**

| | 1985 | Change | 1986 | Change |
|---|---|---|---|---|
| Coal (million tons) | 517 | +8.4% | 509 | −1.5% |
| Oil (million bbl) | 171 | −10.0% | 215 | +25.7% |
| Gas (billion cu. ft.) | 2,844 | −4.3% | 2,234 | −15.5% |

**TABLE 2**
**PEAK DEMAND AND RESERVE MARGINS**

| | 1985 | Change | 1986 | Change |
|---|---|---|---|---|
| Seasonal Peak (MW) | 383,264 | +2.8% | 385,347 | +0.5% |
| Total System Capability (MW) | 461,053 | +0.9% | 462,259 | +2.3% |
| System Reserve Margin | 21.9% | | 24.5% | |
| Total Owned Capability (MW) | 461,254 | +2.8% | 462,300 | +0.2% |
| Owned Reserve Margin | 17.2% | | 18.9% | |
| Average Load Factor | 59.9 | | 56.0 | |

**TABLE 3**
**TYPE OF GENERATION (MW)**

| Type | 1985 | Change | 1986 | Change |
|---|---|---|---|---|
| Conventional Steam & Combined Cycle | 354,880 | +4.1% | 353,897 | −0.3% |
| Hydro & Pumped Storage | 27,897 | +13.2% | 28,243 | +0.9% |
| Gas Turbines & Internal Combustion | 34,258 | −0.3% | 34,081 | −0.6% |
| Nuclear | 58,741 | +13.9% | 67,027 | +14.1% |
| Total | 475,836 | +5.4% | 483,088 | +1.5% |

### Natural gas use

Natural gas consumption by those surveyed in *EL&P's* report fell 15.5 percent last year. It had decreased in 1985 by four percent.

Utilities with the largest increases in natural gas consumption in 1986 (among those consuming at least one billion cubic feet last year) were:

○ SCANA...up 283 percent to 1.1 billion cubic feet.
○ Southern Company...up 122 percent to 13.5 billion cubic feet.
○ Public Service of Colorado...up 31 percent to 1.7 billion cubic feet, and
○ Gulf States Utilities...up 12 percent to 163.3 billion cubic feet.

Utilities in the Top 100 with the largest decreases in natural gas consumption last year (among those consuming at least one billion cubic feet) were:

○ Delmarva Power & Light...down 83 percent to 1.0 billion cubic feet.
○ Florida Power Corp...down 81 percent to 1.5 billion cubic feet.
○ Boston Edison...down 74 percent to 8.6 billion cubic feet.
○ Northeast Utilities...down 69 percent to 1.5 billion cubic feet, and
○ Tucson Electric Power...down 40 percent to 2.7 billion cubic feet.

### Thermal efficiency fell

The large table showing individual company fuel consumption also ranks the Top 100 by system heat rate.

Utility thermal efficiency fell slightly in 1986 for the first time in five years. The median in 1986 was 10,610 Btu/kWh, compared to 10,605 Btu/kWh in 1985. It was 10,616 in 1984, 10,650 in 1983 and 10,790 in 1982.

Among all the Top 100, 43 utilities improved their system heat rates last year, while 55 companies had higher heat rates than in 1985.

For the third consecutive year, Commonwealth Energy was ranked

as the most efficient utility in the nation. Consumers Power Company ranked second in 1986, as it did a year earlier. Toledo Edison jumped from its 15th place rank in 1985 to third in this year's report. Florida Power Corp. moved from 5th to 4th, while American Electric Power dropped to 5th from its 1985 2nd place ranking.

### Enough similarities

*EL&P* feels that although there are many differences among the Top 100 companies, there are enough similarities to make valid comparisons.

The Top 20 most efficient baseloaded generating units in the country as reported in the Uniform Statistical Reports are shown in Table 4. Leaders in fossil-boiler heat rate are listed in Table 5. (The effect on heat rates of nuclear units, gas turbines, and diesel engines is eliminated.)

The top three units in 1986 were the same top three in 1985. Duke Power's Belews Creek-2 headed the list once again, followed by the utility's Marshall-3 and Marshall-4 units. Duke Power had 6 of the 11 most efficient units in the country last year.

Also, Duke Power had the best system heat rate for fossil-fueled boilers in 1986, an honor it held in 1985. The only newcomer to the system heat rate leaders was United Illuminating, which had the 9th most efficient fossil

**TABLE 4**
**TOP GENERATING UNITS — BY HEAT RATE**
**(CF > 50%)**

| Unit | Capacity (MW) | Utility | Heat Rate (Btu/KWh) |
|---|---|---|---|
| 1. Belews Creek - 2 | 1,120 | Duke Power | 8,913 |
| 2. Marshall - 3 | 630 | Duke Power | 8,976 |
| 3. Marshall - 4 | 630 | Duke Power | 8,992 |
| 4. Belews Creek - 1 | 1,120 | Duke Power | 9,094 |
| 5. Morgantown - 2 | 582 | Potomac Electric | 9,106 |
| 6. Allen King - 1 | 560 | Northern States Power | 9,113 |
| 7. Canal - 1 | 568 | Commonwealth Energy | 9,123 |
| 8. JH Campbell - 3 | 719 | Consumers Power | 9,138 |
| 9. Amos - 2 | 800 | American Electric Power | 9,146 |
| 10. Marshall - 1 | 385 | Duke Power | 9,160 |
| 11. Marshall - 2 | 385 | Duke Power | 9,268 |
| 12. Crystal River - 5 | 717 | Florida Power Corp. | 9,272 |
| 13. Mountaineer - 1 | 1,300 | American Electric Power | 9,297 |
| 14. Sporn - 5 | 450 | American Electric Power | 9,305 |
| 15. Crystal River - 4 | 717 | Florida Power Corp. | 9,315 |
| 16. JH Campbell - 1 | 265 | Consumers Power | 9,324 |
| 17. Bowen - 4 | 866 | Southern Company | 9,344 |
| 18. Stuart - 1 | 228 | Cincinnati Gas & Electric | 9,364 |
| 19. Bay Shore - 1 | 136 | Toledo Edison | 9,368 |
| 20. Ft. Myers - 2 | 402 | FPL Group | 9,400 |

## HEAT RATES AND FUEL CONSUMPTION

| Company | Rank | Heat Rate (Btu/KWh) | Up or Down | Coal (1000 tons) | Oil (1000 bbl) | Gas (1000 MCF) | Percent Change in Coal | Oil | Gas |
|---|---|---|---|---|---|---|---|---|---|
| Commonwealth Energy | 1 | 9,739 | U | 0 | 7,367 | 889 | — | + 9 | - 87 |
| Consumers Power | 2 | 9,808 | D | 6,642 | 632 | 146 | + 10 | +214 | - 51 |
| Toledo Edison | 3 | 9,860 | D | 2,489 | 2 | 48 | + 10 | - 33 | - 38 |
| Florida Power Corp. | 4 | 9,865 | D | 5,451 | 10,117° | 1,479 | + 8 | + 47 | - 81 |
| American Electric Power | 5 | 9,879 | D | 41,751 | 0 | 23 | + 0.4 | — | - 4 |
| Duke Power | 6 | 9,881 | D | 11,135 | 126 | 328 | + 9 | - 98 | +116 |
| Southwestern Public Service | 7 | 9,927 | D | 6,803 | 2 | 28,712 | - 3 | - 75 | - 36 |
| United Illuminating | 8 | 9,934 | D | 763 | 5,640 | 93 | - 1 | + 5 | +100 |
| Cincinnati Gas & Electric | 9 | 9,941 | D | 7,492 | 13 | 62 | + 1 | - 38 | - 29 |
| DPL, Inc. | 10 | 9,954 | U | 5,387 | 8 | 14 | + 19 | + 33 | +133 |
| New York State Electric & Gas | 11 | 9,959 | D | 5,334 | 22 | — | - 12 | + 57 | — |
| Allegheny Power | 12 | 10,023 | U | 14,674 | 0 | 0 | - 5 | — | — |
| Public Service Indiana | 13 | 10,048 | D | 10,901 | 2 | 0 | - 9 | — | — |
| Potomac Electric | 14 | 10,067 | D | 6,333 | 4,289 | 0 | + 3 | + 10 | — |
| Detroit Edison | 15 | 10,080 | U | 15,930 | 1,359 | 12,690 | + 2 | +107 | + 20 |
| Central Illinois Light | 16 | 10,094 | D | 2,091 | 0 | 14 | - 3 | — | +100 |
| Boston Edison | 17 | 10,098 | D | 0 | 12,815 | 8,639 | — | + 91 | - 74 |
| Eastern Utilities Associates | 18 | 10,159 | D | 344 | 5,877 | 0 | - 33 | +119 | -100 |
| Southern Company | 19 | 10,162 | D | 42,696 | 356 | 13,515 | - 3 | + 98 | +122 |
| Washington Water Power | 20 | 10,171 | D | 1,082 | 2 | 9 | - 1 | — | — |
| SCANA | 21 | 10,179 | U | 3,691 | 4 | 1,107 | - 8 | - 60 | +283 |
| Central Hudson Gas & Electric | 22 | 10,186 | D | 0 | 6,007 | 553 | — | + 10 | - 88 |
| Teco Energy | 23 | 10,196 | D | 5,745 | 166 | 0 | - 7 | - 76 | — |
| New England Electric | 24 | 10,208 | U | 2,860 | 9,872 | 10 | - 4 | + 24 | -100 |
| Illinois Power | 25 | 10,266 | U | 7,744 | 140 | 403 | + 1 | +115 | + 33 |
| Carolina Power & Light | 26 | 10,328 | U | 9,451 | 18 | 525 | + 1 | - 80 | - 54 |
| Orange & Rockland | 27 | 10,346 | D | 0 | 2,200 | 15,978 | — | + 66 | - 25 |
| Union Electric | 28 | 10,364 | U | 9,979 | 83 | 297 | - 2 | +246 | - 13 |
| Duquesne Light | 29 | 10,375 | D | 4,769 | 71 | 160 | + 3 | - 39 | +100 |
| Dominion Resources | 30 | 10,386 | D | 9,139 | 4,839 | 285 | + 14 | +242 | - 78 |
| Midwest Energy □ | 31 | 10,393 | — | 1,923 | 9 | 317 | — | — | — |
| Pennsylvania Power & Light † | 32 | 10,407 | D | 10,162 | 9,259 | 0 | - 8 | + 24 | — |
| Gulf States Utilities † | 32 | 10,407 | D | 2,625 | 442 | 163,335 | - 0.3 | +1,063 | + 12 |
| Central & South West | 34 | 10,414 | U | 12,980 | 100 | 254,275 | - 1 | - 42 | - 9 |
| FPL Group | 35 | 10,423 | D | 2 | 24,500 | 122,969 | +200 | +112 | + 8 |
| Niagara Mohawk Power | 36 | 10,430 | D | 2,462 | 9,620 | 20,960 | - 17 | + 92 | + 15 |
| Houston Lighting & Power | 37 | 10,434 | U | 8,680 | 124 | 283,788 | - 17 | +121 | - 14 |
| Cleveland Electric Illuminating | 38 | 10,464 | U | 6,827 | 86 | 0 | + 2 | + 5 | — |
| Wisconsin Power & Light | 39 | 10,480 | D | 3,773 | 24 | 197 | + 4 | + 9 | +302 |
| Hawaiian Electric | 40 | 10,492 | U | 0 | 11,198 | 0 | — | + 5 | — |
| Baltimore Gas & Electric | 41 | 10,493 | D | 4,092 | 1,419 | 928 | + 18 | - 29 | + 10 |
| Louisville Gas & Electric | 42 | 10,502 | D | 3,852 | 0 | 15 | + 3 | — | - 95 |
| Atlantic Electric | 43 | 10,564 | U | 1,055 | 1,275 | 1,687 | - 1 | + 10 | - 6 |
| Pacific Gas & Electric ø | 44 | 10,571 | — | 0 | 2,097 | 155,522 | — | +159 | - 41 |
| Idaho Power | 45 | 10,572 | U | 1,261 | 1 | 5 | - 59 | — | - 76 |
| Utah Power & Light | 46 | 10,578 | U | 6,419 | 45 | 140 | - 20 | - 48 | - 38 |
| El Paso Electric | 47 | 10,592 | D | 362 | 0 | 15,515 | + 27 | -100 | + 6 |
| Long Island Lighting | 48 | 10,596 | D | 0 | 15,622 | 24,526 | — | - 2 | - 13 |
| Savannah Electric | 49 | 10,607 | U | 852 | 202 | 679 | - 0.4 | +432 | + 45 |
| Kansas City Power & Light | 50 | 10,610 | D | 5,418 | 82 | 217 | - 0.1 | - 7 | - 12 |
| Central Maine Power | 51 | 10,611 | U | 0 | 3,071 | 0 | — | + 29 | — |
| Southern Indiana Gas & Electric | 52 | 10,617 | D | 2,161 | 0 | 152 | + 4 | — | - 11 |
| UtiliCorp United | 53 | 10,620 | D | 1,418 | 6 | 60 | + 12 | +200 | +329 |
| Ohio Edison | 54 | 10,643 | U | 11,148 | 62 | 0 | - 3 | +182 | — |
| IPALCO † | 55 | 10,659 | U | 5,071 | 50 | 0 | + 5 | - 37 | — |
| Northeast Utilities † | 55 | 10,659 | D | 394 | 13,662 | 1,460 | + 3 | + 14 | - 69 |
| Central Louisiana Electric | 57 | 10,672 | U | 396 | 0 | 34,102 | - 42 | — | - 15 |
| Central Illinois Public Service | 58 | 10,686 | U | 4,735 | 21 | 0 | - 7 | + 50 | — |
| Northern States Power | 59 | 10,704 | U | 6,694 | 94 | 695 | - 11 | +194 | + 55 |
| Rochester Gas & Electric | 60 | 10,706 | U | 527 | 330 | 71 | - 32 | - 33 | + 22 |
| Kentucky Utilities | 61 | 10,722 | D | 4,962 | 0 | 1 | + 3 | -100 | — |
| San Diego Gas & Electric | 62 | 10,735 | D | NA | 2,588 | 32,280 | — | -141 | - 25 |
| Delmarva Power & Light † | 63 | 10,736 | U | 2,666 | 3,409 | 1,001 | - 3 | + 37 | - 83 |
| Iowa-Illinois Gas & Electric † | 63 | 10,736 | D | 2,447 | 11 | 616 | + 30 | - 8 | + 2 |
| Southern California Edison † | 65 | 10,739 | U | 5,251 | 1,348 | 186,531 | + 67 | - 42 | - 32 |
| Public Service Enterprise † | 65 | 10,739 | U | 3,603 | 6,160 | 24,354 | - 16 | - 13 | - 36 |
| Northern Indiana Public Service | 67 | 10,799 | D | 4,056 | 28 | 731 | - 6 | - 38 | - 3 |
| Middle South Utilities | 68 | 10,803 | D | 8,281 | 2,166 | 221,123 | + 6 | +846 | - 4 |
| Public Service New Hampshire | 69 | 10,809 | U | 917 | 4,661 | 0 | - 36 | + 92 | — |
| Iowa Power & Light | 70 | 10,818 | D | 2,042 | 23 | 208 | - 1 | + 64 | - 49 |
| Sierra Pacific Power | 71 | 10,820 | U | 848 | 312 | 1,425 | + 23 | +3,367 | - 56 |
| Philadelphia Electric | 72 | 10,836 | D | 2,437 | 4,505 | 452 | - 18 | - 2 | - 56 |
| PacifiCorp | 73 | 10,846 | U | 10,233 | 64 | — | - 19 | - 7 | — |
| Wisconsin Public Service | 74 | 10,883 | D | 3,322 | 35 | 82 | + 9 | - 14 | +203 |
| Public Service Colorado | 75 | 10,886 | U | 6,784 | 29 | 1,720 | + 2 | - 3 | + 31 |
| AZP Group | 76 | 10,901 | D | 5,536 | 11 | 10,039 | - 13 | - 93 | - 39 |
| Central Vermont Public Service | 77 | 10,906 | D | 24△ | 60 | 0 | - 72 | + 30 | — |
| Oklahoma Gas & Electric | 78 | 10,912 | U | 5,830 | 24 | 107,292 | - 10 | + 20 | - 2 |
| Wisconsin Energy | 79 | 10,928 | U | 6,594 | 110 | 674 | + 7 | - 24 | +174 |
| Texas Utilities Electric | 80 | 10,933 | D | 31,711 | 122 | 364,511 | + 8 | - 87 | - 9 |
| Puget Sound Power & Light | 81 | 10,936 | D | 2,498 | 4 | 63 | + 9 | - 43 | + 2 |
| Consolidated Edison | 82 | 10,970 | D | 0 | 17,591 | 76,511 | — | + 17 | - 7 |
| Commonwealth Edison | 83 | 10,977 | D | 13,647 | 4,081 | 3,579 | - 0.2 | + 61 | - 2 |
| Madison Gas & Electric | 84 | 10,993 | U | 682 | 8 | 941 | - 11 | +100 | + 20 |
| Empire District Electric | 85 | 10,995 | D | 1,071 | 13 | 248 | - 10 | + 86 | - 58 |
| Minnesota Power | 86 | 10,996 | U | 2,891 | 0 | 0 | - 12 | — | — |
| Kansas Gas & Electric | 87 | 11,001 | D | 2,703 | 0 | 7,244 | - 7 | -100 | - 39 |
| General Public Utilities | 88 | 11,004 | U | 6,843 | 1,694 | 11,088 | - 76 | +152 | - 3 |
| Tucson Electric | 89 | 11,062 | U | 1,948 | 0 | 2,687 | - 10 | — | - 40 |
| Nevada Power | 90 | 11,067 | U | 2,420 | 96 | 3,365 | + 6 | + 33 | + 0.5 |
| Montana Power | 91 | 11,101 | D | 3,025 | 9 | 412 | + 24 | - 64 | - 7 |
| Portland General Electric | 92 | 11,118 | D | 897 | 4 | 0 | + 2 | + 75 | — |
| Iowa Electric Light & Power | 93 | 11,212 | D | 1,018 | 15 | 209 | + 9 | + 7 | + 55 |
| Interstate Power | 94 | 11,244 | U | 1,868 | 12 | 794 | - 12 | - 8 | + 50 |
| Kansas Power & Light | 95 | 11,330 | U | 5,990 | 11 | 1,230 | + 1 | - 27 | - 4 |
| Public Service New Mexico | 96 | 11,597 | U | 3,688 | 21 | 907 | - 13 | +200 | - 34 |
| Otter Tail Power | 97 | 11,854 | U | 1,796 | 3 | 0 | - 10 | + 50 | — |
| Centel | 98 | 12,147 | D | 905 | 1 | 3,885 | + 4 | - 67 | - 15 |
| MDU Resources | 99 | 12,269 | D | 1,342 | 10 | 8 | - 15 | + 25 | - 47 |
| TNP Enterprise | 100 | >20,000 | U | 0 | 0 | 5 | — | — | - 29 |

△ Wood
° Doesn't include heat recovery of 261 MWH
NA Not available
° Includes 18,000 barrels of oil/coal mixture

† Tie
□ 1985 figures, 1986 Not available
ø 1985 Heat rate, other figures preliminary 1986.

## PEAK DEMAND AND CAPABILITY

| Company | Season Peak MW | % Change | Winter (W) or Summer (S) | Total System Capacity MW (at time of peak) | Total System Reserve % | Owned Capacity MW (at time of peak) | Owned Reserve % | Load Factor % |
|---|---|---|---|---|---|---|---|---|
| Allegheny Power System | 5,674 | - 5.9 | W | 7,012 | 24 | 7,935 | 40 | 67.8 |
| American Electric Power | 15,555 | -23.2 | W | 22,786 | 46 | 22,827 | 47 | 64.8 |
| Atlantic Electric | 1,459 | + 1.9 | S | 1,606 | 10 | 1,481 | 2 | 55.3 |
| AZP Group | 3,153 | - 1.4 | S | 3,473 | 10 | 3,290 | 4 | 53.2 |
| Baltimore Gas & Electric | 4,818 | + 5.8 | S | 5,656 | 22 | 5,403 | 17 | 58.3 |
| Boston Edison | 2,254 | -16.0 | S | 2,874 | 28 | 2,708 | 20 | 64.8 |
| Carolina Power & Light | 7,402 | - 1.3 | W | 8,916 | 21 | 8,635 | 17 | 57.7 |
| Centel | 590 | - 2.6 | S | NA | NA | 663 | 12 | NA |
| Central & South West | 10,243 | + 4.5 | S | 13,223 | 29 | 13,049 | 27 | 54.7 |
| Central Hudson Gas & Electric | 764 | + 3.4 | S | 1,047 | 37 | 983 | 29 | 66.7 |
| Central Illinois Light | 866 | + 3.8 | S | 1,086 | 25 | 1,136 | 31 | 61.1 |
| Central Illinois Public Service | 1,621 | - 1.9 | S | 2,579 | 59 | 2,805 | 73 | 56.9 |
| Central Louisiana Electric | 1,182 | +11.0 | S | 1,708 | 45 | 1,681 | 42 | 53.4 |
| Central Maine Power | 1,453 | + 5.7 | W | 1,667 | 15 | 966 | -34 | 68.4 |
| Central Vermont Public Service | 389 | - 7.3 | W | 486 | 25 | 94 | -76 | 58.9 |
| Cincinnati Gas & Electric | 3,434 | + 3.5 | S | 4,030 | 17 | 4,030 | 17 | 57.8 |
| Cleveland Electric Illuminating | 3,601 | +10.6 | S | 4,315 | 20 | 4,315 | 20 | 62.2 |
| Commonwealth Edison | 15,100 | +13.9 | S | 19,735 | 31 | 19,161 | 27 | 53.3 |
| Commonwealth Energy System | 757 | - 1.9 | W | 935 | 24 | 225 | -70 | 65.0 |
| Consolidated Edison | 7,641 | - 0.4 | S | 10,104 | 32 | 9,200 | 20 | 49.6 |
| Consumers Power | 5,127 | + 8.3 | S | 5,963 | 16 | 6,283 | 23 | 65.1 |
| Delmarva Power & Light | 1,840 | + 5.8 | S | 2,277 | 24 | 2,277 | 24 | 63.3 |
| Detroit Edison | 8,050 | +12.2 | S | 9,199 | 14 | 9,321 | 16 | 57.9 |
| Dominion Resources | 10,358 | + 0.4 | S | 12,511 | 21 | 11,405 | 10 | 58.8 |
| DPL, Inc. | 2,247 | - 1.0 | S | 2,651 | 18 | 2,651 | 19 | 60.4 |
| Duke Power | 12,586 | - 0.8 | W | 14,790 | 18 | 14,602 | 16 | 59.8 |
| Duquesne Light | 2,132 | + 0.2 | S | 2,920 | 37 | 2,859 | 34 | 60.6 |
| Eastern Utilities Associates | 698 | - 5.4 | S | 888 | 27 | 587 | -16 | 64.6 |
| El Paso Electric | 938 | + 7.0 | S | 891 | -5 | 1,104 | +18 | 59.9 |
| Empire District Electric | 612 | +12.7 | S | 704 | 15 | 642 | 5 | 48.1 |
| Florida Progress (FPC) | 5,977 | + 2.8 | W | 6,780 | 13 | 5,989 | 0.2 | 43.3 |
| FPL Group (FP&L) | 12,139 | - 3.1 | W | 11,598 | -4 | 14,068 | 16 | 54.8 |
| General Public Utilities | 6,606 | - 1.2 | S | 9,586 | 45 | 7,787 | 18 | NA |
| Gulf States Utilities | 5,089 | +0.02 | S | 7,548 | 48 | 6,689 | -31 | 63.5 |
| Hawaiian Electric Industries | 1,205 | + 5.1 | W | 1,535 | 27 | 1,489 | 24 | 71.2 |
| Houston Industries | 10,556 | - 0.4 | S | 13,258 | 26 | 11,863 | 12 | 57.0 |
| Idaho Power | 2,089 | - 9.1 | S | 2,728 | 31 | 2,548 | 22 | 63.0 |
| IE Industries | 954 | + 3.5 | S | 1,147 | 20 | 1,047 | 10 | 56.2 |
| Illinois Power | 2,949 | + 6.4 | S | 4,172 | 42 | 3,740 | 27 | 63.0 |
| Interstate Power | 768 | + 4.1 | S | 953 | 24 | 950 | 24 | 60.7 |
| Iowa-Illinois Gas & Electric | 950 | - 1.6 | S | 1,198 | 26 | 1,452 | 53 | 52.9 |
| Iowa Resources | 1,178 | + 6.1 | S | 1,389 | 18 | 1,141 | - 3 | 49.0 |
| IPALCO | 2,191 | + 7.2 | S | 2,911 | 33 | 2,911 | 33 | 56.9 |
| Kansas City Power & Light | 2,373 | + 6.2 | S | 2,937 | 24 | 2,937 | 24 | 48.0 |
| Kansas Gas & Electric | 1,604 | + 3.6 | S | 2,428 | 51 | 2,434 | 52 | 51.2 |
| Kansas Power & Light | 1,844 | + 6.7 | S | 2,356 | 28 | 2,531 | 37 | 50.0 |
| Kentucky Utilities | 2,406 | - 1.9 | S | 3,375 | 40 | 3,130 | 30 | 57.5 |
| Long Island Lighting | 3,441 | + 1.8 | S | NA | NA | NA | NA | NA |
| Louisville Gas & Electric | 1,913 | + 5.6 | S | 2,312 | 21 | 2,312 | 21 | 52.1 |
| Madison Gas & Electric | 447 | + 9.0 | S | 599 | 34 | 587 | 31 | 53.0 |
| MDU Resources Group | 338 | - 3.4 | S | 449 | 33 | 408 | 21 | 59.2 |
| Middle South Utilities | 11,697 | + 7.6 | S | 16,382 | 40 | 16,321 | 40 | 54.4 |
| Midwest Energy | NA | NA | NA | NA | NA | NA | NA | NA |
| Minnesota Power | 1,026 | - 3.1 | W | 1,482 | 44 | 1,240 | 21 | 72.0 |
| Montana Power | 1,233 | - 4.8 | W | 1,704 | 36 | 1,524 | 24 | 68.0 |
| Nevada Power | 1,661 | + 1.0 | S | 1,993 | 20 | 1,741 | 5 | 46.1 |
| New England Electric | 3,520 | - 1.0 | W | 4,326 | 23 | 3,891 | 11 | 64.7 |
| NY State Electric & Gas | 2,252 | - 1.7 | W | 3,004 | 33 | 2,441 | 8 | 66.3 |
| Niagara Mohawk Power | 5,724 | - 2.4 | W | 7,803 | 36 | 5,320 | - 7 | 67.9 |
| Northeast Utilities | 4,242 | - 2.3 | W | 5,487 | 29 | 6,223 | 47 | 66.0 |
| Northern Indiana Pub. Service | 2,324 | + 9.8 | S | 3,796 | 63 | NA | NA | 61.5 |
| Northern States Power | 6,012 | +15.5 | S | 6,889 | 15 | 6,121 | 2 | 56.2 |
| Ohio Edison | 4,243 | + 3.9 | S | 5,588 | 32 | 5,402 | 27 | 66.2 |
| Oklahoma Gas & Electric | 4,614 | + 3.7 | S | 5,701 | 37 | 5,655 | 23 | 46.4 |
| Orange & Rockland Utilities | 822 | + 4.1 | S | 1,027 | 25 | 1,011 | 23 | 51.3 |
| Otter Tail Power | 515 | - 7.4 | W | 685 | 33 | 598 | 16 | 61.4 |
| Pacific Gas & Electric | 13,452 | - 6.6 | S | 20,164 | 50 | 15,204 | 13 | 64.4 |
| PacifiCorp | 3,841 | - 9.7 | W | 5,140 | 34 | 4,007 | 4 | 68.0 |
| Pennsylvania Power & Light | 5,154 | + 3.5 | W | 7,519 | 46 | 8,360 | 62 | 62.1 |
| Philadelphia Electric | 6,135 | + 1.7 | S | 6,039 | -2 | 7,858 | 28 | 58.1 |
| Portland General Electric | 2,659 | - 8.2 | W | 4,364 | 64 | 2,696 | 1 | 61.2 |
| Potomac Electric Power | 4,702 | + 0.4 | S | 5,375 | 14 | 5,375 | 14 | 53.2 |
| Public Service Enterprise Group | 7,735 | + 0.2 | S | 9,364 | 21 | 9,007 | 16 | 53.2 |
| Public Service of Colorado | 3,150 | + 3.1 | S | 3,805 | 21 | 2,924 | - 7 | 67.7 |
| Public Service of Indiana | 3,792 | + 3.2 | S | 5,881 | 55 | 5,627 | 48 | 59.6 |
| Public Service of New Hampshire | 1,375 | + 1.3 | W | 1,635 | 19 | 1,285 | - 7 | 58.9 |
| Public Service of New Mexico | 916 | + 6.4 | S | 1,536 | 68 | 1,442 | 57 | 50.1 |
| Puget Sound Power & Light | 3,460 | - 3.2 | W | 4,069 | 18 | 1,650 | -52 | 53.0 |
| Rochester Gas & Electric | 1,100 | + 2.2 | S | 1,439 | 31 | 1,056 | - 4 | 64.7 |
| San Diego Gas & Electric | 2,376 | + 1.8 | S | 3,200 | 35 | 2,531 | 7 | 58.4 |
| Savannah Electric & Power | 485 | +13.4 | S | 620 | 10 | 600 | 6 | 51.1 |
| SCANA Corp. | 2,853 | + 5.5 | S | 3,870 | 36 | 3,890 | 36 | 58.0 |
| Sierra Pacific Resources | 708 | - 0.6 | S | 921 | 30 | 831 | 17 | 72.2 |
| Southern California Edison | 14,599 | + 0.1 | S | 18,147 | 24 | 14,931 | 2 | 57.0 |
| Southern Co. | 22,739 | + 6.8 | S | 24,768 | 9 | 25,810 | 14 | 57.2 |
| Southern Indiana Gas & Electric | 967 | + 7.7 | S | 1,167 | 21 | 1,167 | 21 | 59.3 |
| Southwestern Public Service | 2,912 | + 1.7 | S | 4,251 | 46 | 4,051 | 39 | 62.3 |
| Teco Energy | 2,598 | - 5.1 | W | 2,840 | 9 | 3,020 | +16 | 52.4 |
| Texas Utilities | 16,537 | + 4.0 | S | 18,854 | 14 | 17,804 | 8 | 55.1 |
| TNP Enterprises | NA | NA | NA | NA | NA | NA | NA | NA |
| Toledo Edison | 1,423 | + 3.6 | S | 1,733 | 22 | 1,681 | 18 | 64.8 |
| Tucson Electric Power | 1,151 | + 3.0 | S | 1,420 | 23 | 1,330 | 16 | 57.3 |
| Union Electric | 6,449 | + 7.5 | S | 7,622 | 18 | 7,698 | 19 | 53.8 |
| United Illuminating | 990 | -10.8 | S | 1,295 | 31 | 1,230 | 24 | 59.8 |
| Utah Power & Light | 3,110 | - 4.6 | S | 3,168 | 2 | 3,202 | 3 | 69.4 |
| Utilicorp United | 792 | +10.3 | S | 911 | 15 | 911 | 15 | 44.9 |
| Washington Water Power | 1,286 | -15.5 | W | 1,935 | 51 | 1,357 | 6 | 60.4 |
| Wisconsin Energy | 3,810 | + 8.1 | S | 4,404 | 16 | 4,354 | 14 | 60.0 |
| Wisconsin Power & Light | 1,470 | + 7.2 | S | 1,959 | 33 | 1,901 | 29 | 64.3 |
| Wisconsin Public Service | 1,293 | + 6.0 | S | 1,700 | 32 | 1,688 | 31 | 71.9 |

NA Not available

system.

In the second large table you will find data, summarized in Table 2, that shows peak demand barely rose in 1986, edging up only 0.5 percent. A summer noted by its coolness and a mild winter across much of the nation last year kept peaks from growing as much as predicted, or in previous years.

Companies recording the greatest peak demand growth were:

- Northern States Power...up 15.5 percent to 6,012 MW.
- Savannah Electric...up 13.4 percent to 565 MW.
- Empire District Electric...up 12.7 percent to 612 MW.
- Detroit Edison...up 12.2 percent to 8,050 MW.
- Central Louisiana Electric...up 11.0 percent to 1,182 MW, and
- Cleveland Electric Illuminating ...up 10.6 percent to 3,601 MW.

The 1986 gains in peak demand were not as large as those made in 1985. The top four utility peak demand leaders in 1985 all had a higher percentage increase than 1986's leader Northern States Power.

Summer peakers in 1986 outnumbered winter peakers 74 to 24. Reflecting the warmer than usual winter, there were 24 winter peaking companies in 1986, down from 30 in 1985. Two companies did not provide peak demand data.

Breaking with a three-year rising trend, average load factor (unweighted) for the Top 100 dropped to 56.0 in 1986. It was 59.9 in 1985, 59.6 in 1984, 57.7 in 1983, and 57.5 in 1982.

### System capability

The Top 100's system capability increased 2.3 percent in 1986. For the last several years, the group averaged an increase in the 4,000 to 5,000 MW range. However, in 1986, capability was expanded by approximately 11,000 MW.

Total system reserve margin, which includes both owned-reserves and firm purchase power contracts, took a turn skyward in 1986 to 24.5 percent, from 1985's 21.9 percent. System reserve hit an all-time high in 1982 of 29 percent, then had dropped at the rate of about two percentage points a year.

At the same time, owned-reserve margins decreased in 1986 to 16.9 percent, from 1985's 17.2 percent.

In its 1987 *Electric Supply & Demand* report, the North American Electric Reliability Council says growth rates for peak demand and annual energy are slightly lower than those in 1986. NERC reports that summer 1987 peak demand will be 534,000 MW and winter peak demand will be 512,000 MW.

To serve anticipated demands, NERC said utility systems are planning to increase their net capacity resources by about 80,000 MW over the 1987-1996 period, an average annual growth rate of 1.2 percent.

A recent Utility Data Institute (UDI) report warned of power shortages before the end of the century, unless the electric utility industry expands capacity substantially beyond what is currently being planned. The report predicts that installed capacity will exceed available capacity by

1997.

UDI noted that the Southeastern and South Central regions of the U.S. face the severest prospects of supply shortages. Both regions are expected to experience negative operating margins by 1993.

Also, stated the institute, the probability of shortages in the Midwest and Mid-Atlantic states by the end of the century is greater than 50 percent. The risk of power shortages in New England, most of Texas, and the West is less than 50 percent but still significant.

Done by Applied Economic Research Company for UDI, the report forecasts an average national electricity demand growth of nearly 2.4 percent annually. The amount of capacity required to meet predicted load in 1997 will be 664,000 MW, about 44 percent more than was required in 1985, said UDI.

The Edison Electric Institute is forecasting a 2.2 percent level of growth, while the National Coal Association expects a 2.0 percent growth rate. Electric utility consultant John O. Sillin, who works for Management Analysis Company, has predicted a growth rate of between 2 and 2.5 percent for 1987.

### Generating capacity

Generating capacity for the Top 100 rose a modest 1.5 percent in 1986, as seen in Table 3. The share of total capacity represented by conventional steam and combined cycle capacity declined 0.3 percent. Gas turbine and internal combustion capacity also dropped. Hydro and pumped storage capacity increased, while nuclear capacity jumped 14.1 percent.

It was the fourth consecutive year that nuclear capacity increased. It rose 13.8 percent in 1985, 11 percent in 1984 and 8 percent in 1983.

The Atomic Industrial Forum says that nuclear power accounted for 17 percent of the U.S. electricity supply in 1986. UDI said in the period 1984-1987, domestic utilities have placed, or will place approximately 34 nuclear units into service. After 1987, fewer than 10 remaining nuclear units are scheduled to enter service in the U.S.

### Leading nuclear utilities

The leading nuclear utilities are:

- Commonwealth Edison...8,127 MW.
- Duke Power...7,170 MW.
- Middle South Utilities...3,766 MW.
- Dominion Resources...3,141 MW.
- FPL Group...2,885 MW.

**TABLE 5**
**SYSTEM HEAT RATE LEADERS — FOSSIL — FUELED BOILERS ONLY**

| Utility | Heat Rate (Btu/KWh) |
|---|---|
| 1. Duke Power | 9,261 |
| 2. Consumers Power | 9,675 |
| 3. American Electric Power | 9,730 |
| 4. Commonwealth Energy | 9,735 |
| 5. Florida Power Corp. | 9,776 |
| 6. Toledo Edison | 9,842 |
| 7. DPL Holdings, Inc. | 9,903 |
| 8. SCANA | 9,904 |
| 9. United Illuminating | 9,906 |
| 10. Cincinnati Gas & Electric | 9,933 |

**TYPE OF GENERATION IN THE SYSTEM**

| | Fossil | | | Hydro & Pump Storage | | | Diesel/Combustion Turbines | | | Nuclear | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Company | MW | % | Last Year Change MW | MW | % | Last Year Change MW | MW | % | Last Year Change MW | MW | % | Last Year Change MW |
| Allegheny Power System | 7,069 | 89 | + 33 | 902 | 11 | — | 0 | 0 | 0 | 0 | 0 | 0 |
| American Electric Power | 19,800 | 87 | — | 836 | 4 | — | 61 | 1 | — | 2,130 | 9 | — |
| Atlantic Electric | 842 | 57 | — | 0 | — | — | 368 | 25 | — | 321 | 18 | + 2 |
| AZP Group | 2,431 | 66 | - 92 | 6 | 1 | — | 501 | 14 | — | 739 | 20 | +739 |
| Baltimore Gas & Electric | 2,891 | 53 | -147 | 0 | — | — | 717 | 13 | - 40 | 1,830 | 34 | +160 |
| Boston Edison | 1,802 | 67 | - 69 | 0 | — | — | 239 | 8 | — | 667 | 25 | - 3 |
| Carolina Power & Light | 5,068 | 61 | — | 218 | 3 | — | 1,018 | 12 | — | 1,955 | 24 | — |
| Centel | 500 | 75 | - 55 | 0 | — | — | 163 | 25 | - 55 | 0 | — | — |
| Central & South West | 13,570 | 100 | +841 | 0 | — | — | 0 | — | — | 0 | — | — |
| Central Hudson Gas & Electric | 902 | 92 | + 3 | 43 | 4 | — | 38 | 4 | — | 0 | — | — |
| Central Illinois Light | 1,106 | 93 | — | 0 | — | — | 32 | 3 | - 2 | 0 | — | — |
| Central Illinois Public Service | 2,802 | 99 | - 4 | 0 | 0 | 0 | 3 | 1 | — | 0 | 0 | 0 |
| Central Louisiana Electric | 1,681 | 100 | +320 | 0 | — | — | 0 | — | — | 0 | — | — |
| Central Maine Power | 590 | 59 | — | 337 | 34 | + 6 | 45 | 5 | + 1 | 29 | 2 | + 29 |
| Central Vermont Public Service | 24 | 21 | - 1 | 41 | 36 | — | 29 | 25 | - 3 | 20 | 18 | + 20 |
| Cincinnati Gas & Electric | 3,555 | 88 | — | 0 | 0 | 0 | 475 | 12 | — | 0 | 0 | 0 |
| Cleveland Electric Illuminating | 3,508 | 81 | +631 | 305 | 7 | — | 62 | 2 | — | 440 | 10 | +440 |
| Commonwealth Edison | 9,703 | 49 | — | 624 | 4 | — | 1,331 | 7 | — | 8,127 | 41 | — |
| Commonwealth Energy System | 1,024 | 94 | — | 0 | — | — | 62 | 6 | — | 0 | — | — |
| Consolidated Edison | 6,138 | 68 | +279 | 0 | — | — | 2,076 | 23 | + 1 | 849 | 9 | — |
| Consumers Power | 4,044 | 64 | - 1 | 1,089 | 17 | — | 347 | 6 | - 10 | 803 | 13 | + 14 |
| Delmarva Power & Light | 1,788 | 79 | — | 0 | — | — | 168 | 7 | - 2 | 321 | 14 | + 2 |
| Detroit Edison | 7,860 | 87 | - 30 | 918 | 10 | — | 525 | 3 | — | 0 | 0 | 0 |
| Dominion Resources | 6,031 | 54 | -116 | 1,587 | 14 | + 1 | 439 | 4 | -111 | 3,141 | 28 | + 6 |
| DPL, Inc. | 2,466 | 93 | +175 | 0 | — | — | 183 | 7 | - 27 | 0 | — | — |
| Duke Power | 6,393 | 41 | -210 | 1,452 | 9 | + 30 | 599 | 4 | — | 7,170 | 46 | +1,085 |
| Duquesne Light | 2,457 | 84 | -306 | 0 | — | — | 66 | 3 | + 66 | 385 | 13 | — |
| Eastern Utilities Associates | 509 | 85 | — | 0 | — | — | 47 | 8 | — | 46 | 7 | + 46 |
| El Paso Electric | 833 | 64 | - 87 | 0 | — | — | 69 | 5 | 0 | 401 | 31 | +401 |
| Empire District Electric | 432 | 67 | + 20 | 16 | 3 | — | 195 | 30 | — | 0 | — | — |
| Florida Progress (FPC) | 4,175 | 70 | - 2 | 0 | — | — | 1,083 | 18 | — | 731 | 12 | + 64 |
| FPL Group (FP&L) | 8,279 | 63 | -614 | 0 | — | — | 1,924 | 15 | - 26 | 2,885 | 22 | + 14 |
| *General Public Utilities | 4,067 | 49 | - 62 | 307 | 4 | - 38 | 1,487 | 18 | — | 2,334 | 28 | — |
| Gulf States Utilities | 5,821 | 89 | — | 0 | — | — | 90 | 1 | — | 655 | 10 | +655 |
| Hawaiian Electric Industries | 1,269 | 85 | - 5 | 0 | — | — | 221 | 15 | + 1 | 0 | — | — |
| Houston Industries | 11,332 | 89 | +140 | 0 | — | — | 1,348 | 11 | +164 | 0 | — | — |
| Idaho Power | 991 | 36 | + 1 | 1,681 | 62 | -105 | 50 | 2 | — | 0 | — | — |
| IE Industries | 541 | 52 | — | 0 | — | — | 156 | 15 | - 1 | 350 | 33 | — |
| Illinois Power | 3,562 | 95 | — | 2 | — | — | 176 | 5 | — | 0 | — | — |
| Interstate Power | 896 | 94 | + 1 | 0 | 0 | 0 | 55 | 6 | — | 0 | — | — |
| Iowa-Illinois Gas & Electric | 1,002 | 69 | - 79 | 3 | 1 | - 1 | 64 | 4 | - 3 | 384 | 26 | — |
| Iowa Resources | 866 | 76 | -188 | 0 | 0 | 0 | 275 | 24 | — | 0 | — | — |
| IPALCO | 2,771 | 97 | +449 | 0 | — | — | 74 | 3 | — | 0 | — | — |
| Kansas City Power & Light | 2,037 | 69 | — | 0 | — | — | 370 | 13 | — | 530 | 18 | — |
| Kansas Gas & Electric | 1,901 | 78 | + 21 | 0 | 0 | 0 | 3 | — | - 20 | 530 | 22 | — |
| Kansas Power & Light | 2,196 | 87 | + 5 | 0 | — | — | 335 | 13 | + 4 | 0 | — | — |
| Kentucky Utilities | 3,111 | 97 | + 21 | 23 | 1 | - 2 | 59 | 2 | — | 0 | — | — |
| Long Island Lighting | 11,302 | 97 | -773 | 0 | — | — | 402 | 3 | +185 | 0 | — | — |
| Louisville Gas & Electric | 2,131 | 95 | + 2 | 79 | 1 | — | 108 | 4 | — | 0 | — | — |
| Madison Gas & Electric | 406 | 69 | — | 0 | — | — | 88 | 15 | — | 94 | 16 | — |
| MDU Resources Group | 347 | 81 | - 2 | 0 | — | — | 81 | 19 | - 5 | 0 | — | — |
| Middle South Utilities | 12,143 | 73 | — | 70 | 1 | — | 537 | 3 | — | 3,766 | 23 | - 157 |
| Midwest Energy | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Minnesota Power | 1,126 | 91 | -154 | 109 | 9 | — | 0 | — | — | 0 | — | — |
| Montana Power | 970 | 65 | +181 | 520 | 35 | — | 5 | — | — | 0 | — | — |
| Nevada Power | 1,312 | 75 | — | 0 | — | — | 429 | 25 | — | 0 | — | — |
| New England Electric | 2,643 | 66 | - 15 | 1,155 | 29 | - 20 | 57 | 1 | — | 140 | 4 | +140 |
| NY State Electric & Gas | 2,366 | 97 | — | 68 | 3 | + 3 | 7 | — | — | 0 | — | — |
| Niagara Mohawk Power | 3,532 | 70 | -174 | 685 | 14 | 68 | 237 | 4 | - 73 | 610 | 12 | — |
| Northeast Utilities | 2,433 | 38 | - 52 | 1,269 | 20 | - 6 | 461 | 7 | - 21 | 2,269 | 35 | +749 |
| Northern Indiana Pub. Service | 3,145 | 93 | +344 | 10 | — | 0 | 241 | 7 | 0 | 0 | — | — |
| Northern States Power | 3,225 | 53 | - 73 | 223 | 3 | + 44 | 1,108 | 18 | +120 | 1,564 | 26 | + 17 |
| Ohio Edison | 4,813 | 89 | — | 0 | — | — | 164 | 3 | — | 425 | 8 | — |
| Oklahoma Gas & Electric | 5,714 | 99 | +117 | 0 | — | — | 59 | 1 | — | 0 | — | — |
| Orange & Rockland Utilities | 902 | 89 | — | 34 | 3 | — | 74 | 7 | — | 0 | — | — |
| Otter Tail Power | 534 | 85 | + 28 | 4 | 1 | — | 87 | 14 | — | 0 | — | — |
| Pacific Gas & Electric | 8,574* | 57 | — | 3,694 | 25 | - 1 | 418 | 3 | + 24 | 2,215 | 15 | 1,016 |
| PacifiCorp | 3,122 | 75 | + 70 | 976 | 24 | — | 26 | — | + 26 | 30 | 1 | + 3 |
| Pennsylvania Power & Light | 5,785 | 69 | — | 146 | 1 | — | 539 | 6 | — | 1,890 | 23 | — |
| Philadelphia Electric | 2,881 | 37 | -320 | 1,290 | 16 | — | 804 | 10 | -476 | 2,883 | 37 | +1,067 |
| Portland General Electric | 1,271 | 47 | +141 | 601 | 22 | — | 122 | 4 | + 6 | 729 | 27 | — |
| Potomac Electric Power | 4,809 | 89 | — | 0 | — | — | 566 | 11 | - 86 | 0 | — | — |
| Public Service Enterprise Group | 4,312 | 43 | — | 165 | 2 | — | 2,713 | 27 | — | 2,842 | 28 | +1,025 |
| Public Service of Colorado | 2,458 | 84 | + 91 | 95 | 3 | + 10 | 174 | 6 | - 13 | 200 | 7 | |
| Public Service of Indiana | 5,411 | 95 | — | 55 | 1 | — | 221 | 4 | — | 0 | — | — |
| Public Service of New Hampshire | 1,098 | 85 | — | 68 | 6 | - 1 | 118 | 9 | — | 0 | — | — |
| Public Service of New Mexico | 1,286 | 82 | + 5 | 0 | — | — | 26 | 3 | — | 260 | 17 | +260 |
| Puget Sound Power & Light | 858 | 46 | +175 | 310 | 17 | — | 703 | 37 | — | 0 | — | — |
| Rochester Gas & Electric | 510 | 48 | + 77 | 47 | 4 | — | 29 | 3 | — | 470 | 45 | — |
| San Diego Gas & Electric | 1,854 | 69 | — | 0 | — | — | 333 | 12 | — | 517 | 19 | — |
| Savannah Electric & Power | 538 | 88 | — | 0 | — | — | 72 | 12 | — | 0 | — | — |
| SCANA Corp. | 2,374 | 61 | + 88 | 756 | 19 | — | 170 | 5 | + 60 | 590 | 15 | — |
| Sierra Pacific Resources | 742 | 89 | + 26 | 8 | 1 | - 4 | 87 | 10 | — | 0 | — | — |
| Southern California Edison | 10,072 | 67 | — | 943 | 6 | + 1 | 1,620 | 11 | — | 2,348 | 16 | +386 |
| Southern Company | 19,650 | 76 | + 64 | 2,591 | 10 | - 13 | 1,131 | 4 | — | 2,438 | 10 | + 44 |
| Southern Indiana Gas & Electric | 1,032 | 88 | +250 | 0 | — | — | 135 | 12 | — | 0 | — | — |
| Southwestern Public Service | 3,945 | 97 | — | 0 | — | — | 106 | 3 | — | 0 | — | — |
| Teco Energy | 2,869 | 95 | + 7 | 0 | — | — | 158 | 5 | — | 0 | — | — |
| Texas Utilities | 17,804 | 100 | 0 | — | — | — | — | — | — | — | — | — |
| TNP Enterprises | 0 | 0 | 0 | 0 | 0 | 0 | 49 | 100 | — | 0 | 0 | 0 |
| Toledo Edison | 1,213 | 71 | — | 0 | — | — | 77 | 4 | — | 421 | 25 | — |
| Tucson Electric Power | 1,113 | 84 | — | 0 | — | — | 218 | 16 | — | 0 | — | — |
| Union Electric | 5,571 | 72 | - 9 | 631 | 8 | — | 386 | 6 | — | 1,109 | 14 | — |
| United Illuminating | 1,112 | 95 | - 12 | 0 | — | — | 17 | 1 | - 5 | 42 | 4 | + 42 |
| Utah Power & Light° | 3,016 | 95 | + 20 | 127 | 4 | — | 19 | 1 | — | 0 | — | — |
| Utilicorp United | 616 | 68 | - 34 | 0 | — | — | 530 | 32 | +234 | 0 | — | — |
| Washington Water Power | 344 | 25 | — | 946 | 68 | — | 101 | 7 | — | 0 | — | — |
| Wisconsin Electric Power | 3,051 | 70 | -216 | 79 | 2 | + 72 | 254 | 6 | - 9 | 970 | 22 | — |
| Wisconsin Power & Light | 1,457 | 77 | — | 43 | 2 | + 1 | 177 | 9 | — | 215 | 11 | — |
| Wisconsin Public Service | 1,269 | 73 | — | 56 | 3 | — | 189 | 11 | — | 217 | 13 | — |

0 Includes Geothermal capacity NA Not available * Includes combined cycle

## TRANSMISSION AND DISTRIBUTION LINES IN OPERATION

| Company | Transmission | | | | Distribution | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Overhead | | | | Underground | | | |
| | 189 kV & Up (circuit miles) | Miles Added | Below 189 kV (circuit miles) | Miles Added | 22 kV & Up (pole miles) | Miles Added | Below 22 kV (pole miles) | Miles Added | 22 kV & Up (cable miles) | Miles Added | Below 22 kV (cable miles) | Miles Added |
| Allegheny Power Systems | 1,107 | 18 | 3,330 | - 15 | 4,625 | - 40 | 48,913 | 360 | 11 | — | 2,871 | 227 |
| American Electric Power | 5,926 | 80 | 15,783 | 14 | 4,939 | 915 | 92,074 | -451 | 327 | 71 | 6,558 | 359 |
| Atlantic Electric | 64 | 0 | 1,168 | 2 | — | — | 5,964 | 36 | — | — | 766 | 32 |
| AZP Group | 2,398† | 54† | 2,295† | 3† | 0 | — | 10,589 | 83 | 0 | — | 6,119 | 427 |
| Baltimore Gas & Electric | 466 | 23 | 611 | - 19 | 741 | 1 | 51,528△ | 193△ | 170 | 1 | 20,679 | NA |
| Boston Edison | 160 | — | 200 | — | 0 | — | 4,555 | — | 0 | — | 7,339 | — |
| Carolina Power & Light | 2,993 | 76 | 3,053 | 7 | 37,237* | 495* | — | — | 3,640* | 476* | — | — |
| Centel | 2,975*† | - 16*† | — | — | 6,609* | - 46* | — | — | 539* | - 92* | — | — |
| Central & South West | 1,813 | 308 | 14,104 | 4,184 | 499 | 17 | 56,433 | 1,623 | 318 | 20 | 5,513 | 267 |
| Central Hudson Gas & Electric | 76 | — | 526 | - 1 | 44 | 0 | 6,335 | 23 | 0 | 0 | 754 | 35 |
| Central Illinois Light | 47 | — | 283 | — | 615 | - 11 | 5,601 | - 8 | 6 | - 1 | 1,693 | 22 |
| Central Illinois Public Service | 305 | 3 | 4,188 | - 53 | — | — | 8,294 | 8 | — | — | 648 | 23 |
| Central Louisiana Electric | 298 | 0 | 767 | 0 | 10,710 | 348 | — | — | 737* | 84* | — | — |
| Central Maine Power | 208 | — | 2,003 | — | 263 | — | 16,790 | — | 6 | — | 594 | — |
| Central Vermont Public Service | 0 | — | 623 | 1 | 0 | 0 | 7,121 | 67 | 0 | 0 | 119 | 15 |
| Cincinnati Gas & Electric | 383 | — | 1,331 | 12 | 513 | 9 | 8,958 | 26 | 27 | 2 | 1,835 | 92 |
| Cleveland Electric Illuminating | 359 | — | 1,993 | + 52 | 0 | — | 9,491 | 17 | 0 | — | 5,305 | 123 |
| Commonwealth Edison | 2,447 | — | 2,444 | + 1 | 35,791* | 55* | — | — | 21,701* | 577* | — | — |
| Commonwealth Energy System | 60 | 0 | 294 | 0 | 1,505 | 6 | 3,332 | 33 | 838 | 48 | 2,191 | 74 |
| Consolidated Edison | 409 | — | 22 | — | 458△ | 20△ | 25,254△ | -181△ | 6,536 | 106 | 57,991 | 49 |
| Consumers Power | 1,918 | — | 7,926 | 13 | 47,710* | 253* | — | — | 6,365* | 180* | — | — |
| Delmarva Power & Light | 263 | — | 1,090 | - 1 | 4,807 | - 3 | 1,759 | - 1 | 1,935 | 187 | 784 | 51 |
| Detroit Edison | 565 | -403 | 3,805 | -619 | 0 | 0 | 29,800 | 139 | 0 | 0 | 7,179 | 145 |
| Dominion Resources | 2,900 | 17 | 2,942 | — | 38,918* | 196* | — | — | 13,546* | 1,061 | — | — |
| DPL, Inc. | 448 | — | 1,339 | 1 | NA | — | NA | — | NA | — | NA | — |
| Duke Power | 3,056 | 1 | 9,292 | 62 | 9,198 | 104 | 47,596 | 538 | 1,948 | 171 | 3,827 | 310 |
| Duquesne Light | 148 | 0 | 513 | 4 | 393 | - 2 | 6,145 | 37 | 416 | 9 | 2,155 | 52 |
| Eastern Utilities Associates | 179 | 1 | 186 | 3 | 2,541 | 3 | 877 | 4 | 734 | 66 | 235 | 13 |
| El Paso Electric | 633 | 0 | 668 | 14 | 1,370 | 25 | 3,032 | 34 | 102 | 8 | 712 | 14 |
| Empire District Electric | 0 | — | 1,225 | - 2 | 0 | — | 4,722 | 78 | 0 | — | 228 | 9 |
| Florida Progress (FPC) | 1,526 | 8 | 2,104 | -552 | 3,630*‡ | — | — | — | — | — | 3,546 | -2,412 |
| FPL Group (FP&L) | 3,196 | 26 | 2,215 | 8 | 34,388* | 591* | — | — | 11,934* | 833* | — | — |
| General Public Utilities | 1,868 | 719 | 3,985 | 425 | 5,000 | 68 | 40,412 | 209 | 1,399 | 34 | 11,891 | 708 |
| Gulf States Utilities | 1,149 | — | 3,564 | 4 | 1,370 | 15 | 17,920 | 116 | 101 | 6 | 1,707 | 27 |
| Hawaiian Electric Industries | — | — | 1,464 | 3 | — | — | 3,835 | 61 | — | — | 2,295 | 20 |
| Houston Industries | 933 | 1 | 2,490 | 12 | 1,385 | 256 | 17,909 | 205 | 1,171 | 78 | 4,306 | 253 |
| Idaho Power | 1,481† | — | 3,177† | 10† | 4,105 | 40 | 13,000 | 9 | 170 | 17 | 4,516 | 132 |
| IE Industries | 67 | — | 3,214 | 2 | — | — | 4,714 | — | — | — | 1,688 | 53 |
| Illinois Power | 485 | — | 2,351 | - 4 | 1,334 | — | 14,184 | -2,318 | 4 | — | 1,061 | 37 |
| Interstate Power | 69 | — | 2,501 | - 67 | NA | NA | NA | NA | — | — | 534 | 12 |
| Iowa-Illinois Gas & Electric | 305 | — | 690 | 51 | 0 | — | 4,620 | 1,269 | 0 | — | 1,150 | 34 |
| Iowa Resources | 345 | — | 1,071 | -107 | — | — | 11,279 | 31 | — | — | 2,248 | 152 |
| IPALCO | 454 | 33 | 607 | - 2 | 0 | — | 4,664 | 12 | 0 | — | 4,021 | 249 |
| Kansas City Power & Light | 295 | — | 1,364 | 8 | 0 | — | 8,802 | 9 | 0 | — | 4,933 | 264 |
| Kansas Gas & Electric | 663 | — | 1,573 | - 19 | — | — | 7,726 | 7 | — | — | 1,931 | 136 |
| Kansas Power & Light | 491 | -300 | 3,869 | 283 | 0 | — | 12,368 | 50 | 0 | — | 450 | 31 |
| Kentucky Utilities | 514 | - 31 | 4,166 | - 42 | 0 | — | 14,177 | 126 | — | — | — | — |
| Long Island Lighting | 1,189* | — | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Louisville Gas & Electric | 131 | — | 760 | 2 | 86 | — | 3,289 | 15 | 0 | — | 1,867 | 62 |
| Madison Gas & Electric | 124 | — | 178 | 1 | 0 | — | 1,075 | — | 0 | — | 623 | 40 |
| MDU Resources Group | 313 | 2 | 2,831 | 8 | 0 | — | 2,849 | 14 | 0 | — | 1,707 | 36 |
| Middle South Utilities | 2,578 | 2 | 7,453 | - 18 | 4,644 | 50 | 65,756 | 452 | 1,621 | 54 | 3,182 | 221 |
| Midwest Energy | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Minnesota Power | 606† | — | 1,491† | 12† | 745 | - 1 | 3,883 | - 18 | 0 | — | 937° | 112° |
| Montana Power | 1,445 | - 4 | 5,393 | 1 | — | — | 12,840 | 22 | — | — | 1,129° | 29° |
| Nevada Power | 613 | 0 | 458 | 0 | 0 | 0 | 2,679 | 28 | 0 | 0 | 2,919 | 287 |
| New England Electric | 602 | 0 | 1,976 | - 1 | 787 | 0 | 16,397 | 118 | 201 | — | 6,985 | 168 |
| NY State Electric & Gas | 813 | -303 | 3,405 | -381 | 2,053 | - 39 | 30,432 | 196 | 1° | — | 220° | — |
| Niagara Mohawk Power | 1,116 | 1 | 8,073 | 7 | 108,065*△ | 226*△ | — | — | 6,978* | 172* | — | — |
| Northeast Utilities | 497 | — | 1,635 | — | 21,087* | -280* | — | — | 5,895* | 376* | — | — |
| Northern Indiana Pub. Service | 332 | — | 2,653 | 17 | 0 | — | 7,636 | 16 | 0 | — | 695 | 37 |
| Northern States Power | 1,461 | 16 | 5,406 | 5 | 0 | — | 25,335 | 267 | 0 | — | 10,920 | 351 |
| Ohio Edison | 621 | - 1 | 4,952 | 30 | 0 | — | 24,667 | 45 | 0 | — | 2,980 | 144 |
| Oklahoma Gas & Electric | 982 | 56 | 3,567 | 21 | 19,522* | 139* | 0 | — | 5,573* | 362* | 0 | — |
| Orange & Rockland Utilities | 80 | — | 471 | — | 0 | — | 4,673 | 48 | 0 | — | 981 | 37 |
| Otter Tail Power | 412 | 5 | 4,845 | -179 | 149 | 0 | 802 | - 28 | 21 | 0 | 1,483 | 23 |
| Pacific Gas & Electric | 4,235 | — | 9,819 | — | 93,000* | — | — | — | — | — | — | — |
| PacifiCorp | 3,238 | 12 | 3,646 | - 66 | 27,665* | 70* | — | — | 7,654* | 375* | — | — |
| Pennsylvania Power & Light | 1,308 | 1 | 0 | — | 2,358 | 25 | 47,761 | 474 | 14 | — | 7,040 | 327 |
| Philadelphia Electric | 733 | - 1 | 364 | — | 61 | — | 11,702 | 7 | 18 | — | 15,707 | 490 |
| Portland General Electric | 1,038 | 0 | 929 | - 12 | 0 | — | 7,977 | -803 | 0 | — | 4,632 | 879 |
| Potomac Electric Power | 773 | 0 | 26 | 0 | 298 | 5 | 4,527 | - 25 | 738 | - 49 | 9,882 | 242 |
| Public Service Enterprise Group | 722 | 29 | 271 | — | 47 | 33 | NA | — | 2,023 | — | 23,479 | — |
| Public Service of Colorado | 1,298 | 23 | 1,606 | - 34 | 1,139 | -309 | 11,072 | -438 | 215 | 14 | 4,807 | 486 |
| Public Service of Indiana | 1,394 | — | 4,003 | - 5 | 0 | — | 18,221 | 112 | 0 | — | 2,287 | 84 |
| Public Service of New Hampshire | 283 | — | 1,458 | - 29 | 9,652* | 180* | — | — | 577* | 68* | — | — |
| Public Service of New Mexico | 1,896 | 45 | 888 | 0 | 4,625 | 91 | 0 | — | 2,093 ø | 137 ø | — | — |
| Puget Sound Power & Light | 419† | 58† | 1,775† | - 55† | 111 | — | 9,946 | — | 37 | — | 4,135 | — |
| Rochester Gas & Electric | 0 | — | 711 | - 8 | 6,699* | —* | — | — | 0 | — | 4,244 | 55 |
| San Diego Gas & Electric | 606 | — | 1,131 | 24 | — | — | 7,270 | 9 | — | — | 6,580 | 285 |
| Savannah Electric & Power | 39 | — | 62 | — | 292 | 1 | 2,290 | 38 | — | — | — | — |
| SCANA Corp. | 788 | 39 | 2,380 | 5 | 7,272 | 89 | 6,017 | 61 | NA | NA | NA | NA |
| Sierra Pacific Resources | 914 | 1 | 2,465 | 32 | 7,513 | 146 | — | — | 2,772 | 191 | — | — |
| Southern California Edison | 5,240 | 50 | 6,364 | 326 | 44,344* | -280* | — | — | 168 | 15 | 44,953 | 2,529 |
| Southern Company | 5,779 | - 1,767 | 19,162 | -1,480 | 87,069* | 1,120* | — | — | 12,982* | 1,457* | — | — |
| Southern Indiana Gas & Electric | 0 | 0 | 829 | 9 | 0 | 0 | 3,182 | 2 | 0 | 0 | 716 | 24 |
| Southwestern Public Service | 1,462 | 88 | 4,018 | 14 | 14,812 | 103 | — | — | 1,178 | 22 | — | — |
| Teco Energy | 354 | 0 | 792 | 16 | 0 | — | 6,527 | 59 | 0 | — | 1,709• | 7• |
| Texas Utilities | 3,870 | 137 | 8,670 | 50 | 3,355 | 294 | 47,979 | 75 | 1,481 | 260 | 7,467 | 157 |
| TNP Enterprises | 20 | 0 | 1,585 | 1 | — | — | 8,661 | 594 | — | — | 427 | 51 |
| Toledo Edison | 158# | — | 1,025# | - 28# | 0 | — | 6,979 | 23 | 0 | — | 747 | 14 |
| Tucson Electric Power | 1,456 | - 1 | 326 | — | 536 | - 7 | 6,692 | 400 | 33 | — | 2,795 | 278 |
| Union Electric | 988 | 1 | 2,632 | 11 | 3,608 | 7 | 20,171 | 160 | 342 | 3 | 7,862 | 167 |
| United Illuminating | 118 | 112 | 106 | 7 | 2 | 0 | 3,022 | 0 | 2 | 0 | 1,094 | 18 |
| Utah Power & Light | 2,295 | 19 | 5,916 | 183 | 15,948* | 230* | — | — | 3,078*° | 118*° | — | — |
| Utilicorp United | 58† | — | 1,235† | 6† | 0 | — | 4,733 | 16 | 0 | — | 599 | 73 |
| Washington Water Power | 544† | - 1† | 1,498† | - 30† | 595 | 7 | 8,686 | - 27 | 0 | — | 1,424 | 165 |
| Wisconsin Energy | 686 | 0 | 1,789 | 5 | 22,215* | - 17* | — | — | 8,470* | 386* | — | — |
| Wisconsin Power & Light | 107 | 0 | 2,623 | - 10 | — | — | 16,644 | -120 | — | — | 1,081 | 9 |
| Wisconsin Public Service | 124 | 0 | 1,476 | - 94 | 17,890* | 1,458* | — | — | 1,497* | - 1,996* | — | — |

* Total All Voltage Levels
† Pole Miles
° Conduit Bank Miles
△ Wire Miles
‡ Circuit Miles
# Lines Miles
ø Conduit and Cable Miles
• Trench Miles
NA Not available

○ Philadelphia Electric...2,883 MW.
○ Public Service Enterprise Group...2,842 MW.
○ Southern Company...2,438 MW.
○ Southern California Edison...2,348 MW, and
○ GPU...2,334 MW.

Because of reporting inconsistencies by the Top 100, summarization and trend spotting in the T&D data is next to impossible.

### Largest transmission additions

Utilities with the largest additions to their high-voltage transmission systems (above 189-kV) in 1986 were:
○ GPU... 719 circuit miles added.
○ Central & South West...308 circuit miles added.
○ Texas Utilities...137 circuit miles added.
○ United Illuminating...112 circuit miles added.
○ Southwestern Public Service...88 circuit miles added, and
○ American Electric Power...80 circuit miles added.

Utilities that added the most to transmission systems below 189-kV:
○ GPU...425 circuit miles added.
○ Southern California Edison...326 circuit miles added.
○ Kansas Power & Light...283 circuit miles added, and
○ Utah Power & Light...183 circuit miles added.

### Distribution additions

For overhead distribution above 22-kV, utilities showing the most growth are:
○ American Electric Power...915 pole miles added.
○ Central Louisiana Electric...348 pole miles added.
○ Texas Utilities...294 pole miles added, and
○ Houston Industries...256 pole miles added.

For lower voltage overhead distribution, less than 22-kV, the leaders included:
○ Central & South West...1,623 pole miles added.
○ Iowa-Ill. Gas & Electric...1,269 pole miles added.
○ TNP Enterprises...594 pole miles added.
○ Duke Power...538 pole miles added, and
○ Pennsylvania Power & Light...474 pole miles added.

### Underground distribution

For underground distribution at voltage levels above 22-kV, the leaders were:
○ Texas Utilities...260 cable miles added.
○ Sierra Pacific Resources...191 cable miles added.
○ Delmarva Power & Light...187 cable miles added, and
○ Duke Power...171 cable miles added.

For underground distribution at voltages below 22-kV, the leaders include:
○ Southern California Edison...2,529 cable miles added.
○ Portland General Electric...879 cable miles added.
○ GPU...708 cable miles added, and
○ Philadelphia Electric...490 cable miles added.

# Instructor station is the key to training simulator effectiveness

The electric power industry has placed more than 100 full-scope plant-specific operator training simulators in the past 20 years. The fidelity and degree of simulation in these training systems is a direct result of the continuing collaboration between utilities and simulator manufacturers.

This high level of cooperation has been driven by the demands of various regulatory agencies to provide the best possible training for today's conventional fossil-fired and nuclear power plant operators.

The evolution of the instructor station is an example of this collaborative process. Recognition of the demands placed on the operators as a result of the increasingly complex processes they are called upon to understand and control has placed growing emphasis on the training program. The old approach, based on training the hand, not the mind, has given way to an integrated, systematic performance-based approach to training.

Today's integrated training programs include extensive classroom study in the theory and principles of operation, coupled with hands-on simulator experience.

As the training has become more intensive, the training simulator has become more complex and the role of the instructor, as manager of the training exercise, is more and more demanding. Because of the increasing complexity of the training process, the instructor station has become increasingly important in teaching operators and assessing their ability to perform.

According to Dr. Karl Feintuch, an authority on training techniques, some of the considerations driving the design process for today's operator stations are as follows:

☐ Enhancing the instructor's capability to monitor and assess student performance.

☐ Elimination of time-consuming typed-in entries.

Typically, the instructor's station for a nuclear control room simulator is separated from the control-room environment. Here is the simulator at Northeast Utilities' Millstone I nuclear plant.

☐ Minimizing the cost and effort required to integrate future software enhancements.

The instructor must be able to easily and rapidly control the training scenario by inserting abnormal plant conditions, performing auxiliary operator functions, and monitoring the trainee's performance by using the features on the station.

Continued on page 30

# *Longer nuclear fuel cycles may account for declines in availability*

Thomas A. Christopher
General Manager
Nuclear Services Integration Div.
Westinghouse Electric Corporation

Most power plants that adopted fuel cycles longer than 12 months so far have failed to achieve hoped-for improvements in availability. The longer fuel cycles appear to have created unanticipated challenges that may account for overall declines in availability in 1986—especially in U.S. nuclear power plants.

Currently, only the U.S. has a majority of its nuclear plants on extended fuel cycles. In the U.S. for example, 33 Westinghouse Pressurized Water Reactors (PWRs) are on 15- or 18-month cycles, while eight are on 12-month cycles (See figure 1). The great majority of Westinghouse PWRs located overseas follow 12 month cycles (See figure 2).

In an effort to obtain optimum fuel economy, Electricite de France has decided to operate its nuclear plants with enrichments equivalent to those for an 18-month cycle, but will continue with 12-month refuelings instead. It will offload only one-quarter of the core, as compared with the one-third that normally would be removed with each 12-month refueling.

In their analysis of the factors affecting the extended fuel cycle decision, utility nuclear managers assumed that there would be an increase in the length of less-frequent refueling outages because there would be more work to be done in the areas of preventive maintenance and technical specification inspections and testings.

It was predicted that this increase in outage duration would be modest and would be more than offset by the total elimination of every third refueling outage in the case of 18-month fuel cycles.

Additionally, it was believed that the equivalent forced-outage rate would not change because the effects of equipment wearout would be offset

cooldown transients.

### Shorter cycles performing better

But industry data on performance to-date contains some surprises.

Historical data show that plants operating on 12-month fuel cycles, both domestically (figure 3) and abroad (figure 4), are operating substantially better than those on extended cycles. Moreover, the gap appears to be widening.

U.S. plants on 12-month cycles outperformed comparable European and Japaneses plants in both 1985 and 1986. U.S. plants with fuel cycles longer than 12 months outperformed their counterparts in Europe and Japan in 1985.

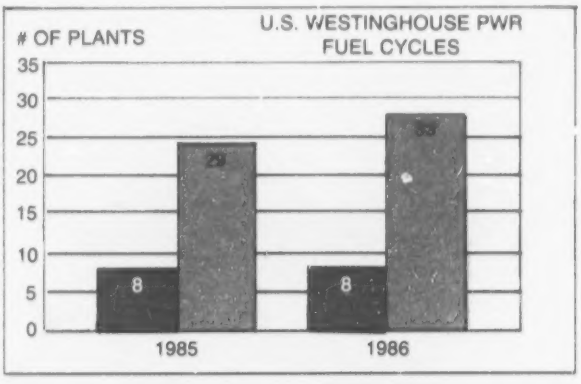
The higher overall availability of European and Japanese plants, compared with the U.S. would appear to be attributable to the much larger number of U.S. nuclear plants on fuel cycles longer than 12 months.

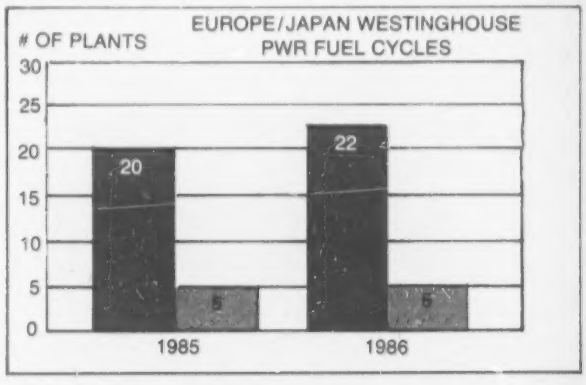
### Forced-outage rates similar

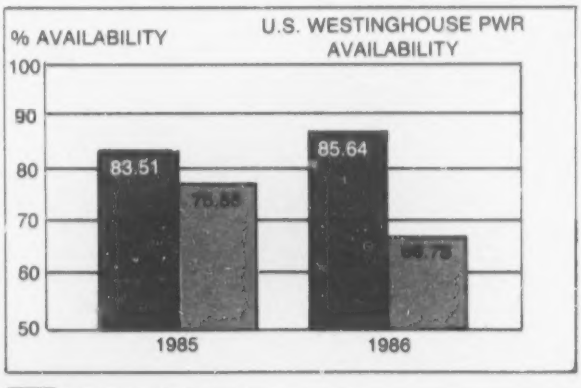
The historical forced-outage rates for long-cycle PWRs has been 15.7 percent since the TMI-2 accident, compared to 18.6 percent for 12-month cycle plants. The difference is not significant. As the recent Electric Power Research Institute report (EPRI NP-5042 Topical Report) shows, there is a high probability of outages due to break-in or startup problems in the first few months of operation, but the plants settle out and the forced-outage rate remains fairly constant through 18 months.

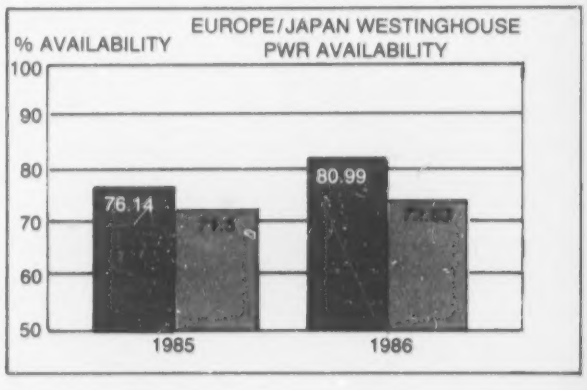
In some cases, actual refueling outage lengths have been greater than expected for long-cycle plants. Aver-

Continued on page 28




12 MO. CYCLE
18 MO. CYCLE

## Shift schedules . . . from page 24

When the schedule the shiftworker is required to work does not match the characteristics of the biological clock, the worker suffers chronic biological upset and distress. Some have compared this distress to jet lag, but as people who have both performed shiftwork and travelled halfway around the world, we'll take jet lag anytime. When there is a conflict between the employees' shift schedules and their biological clocks, compromise is in order.

It is necessary to reset a shiftworker's biological clock if the worker is to be alert and useful at 3:00 a.m. This is best accomplished on a shift schedule that has been specifically designed with these factors in mind.

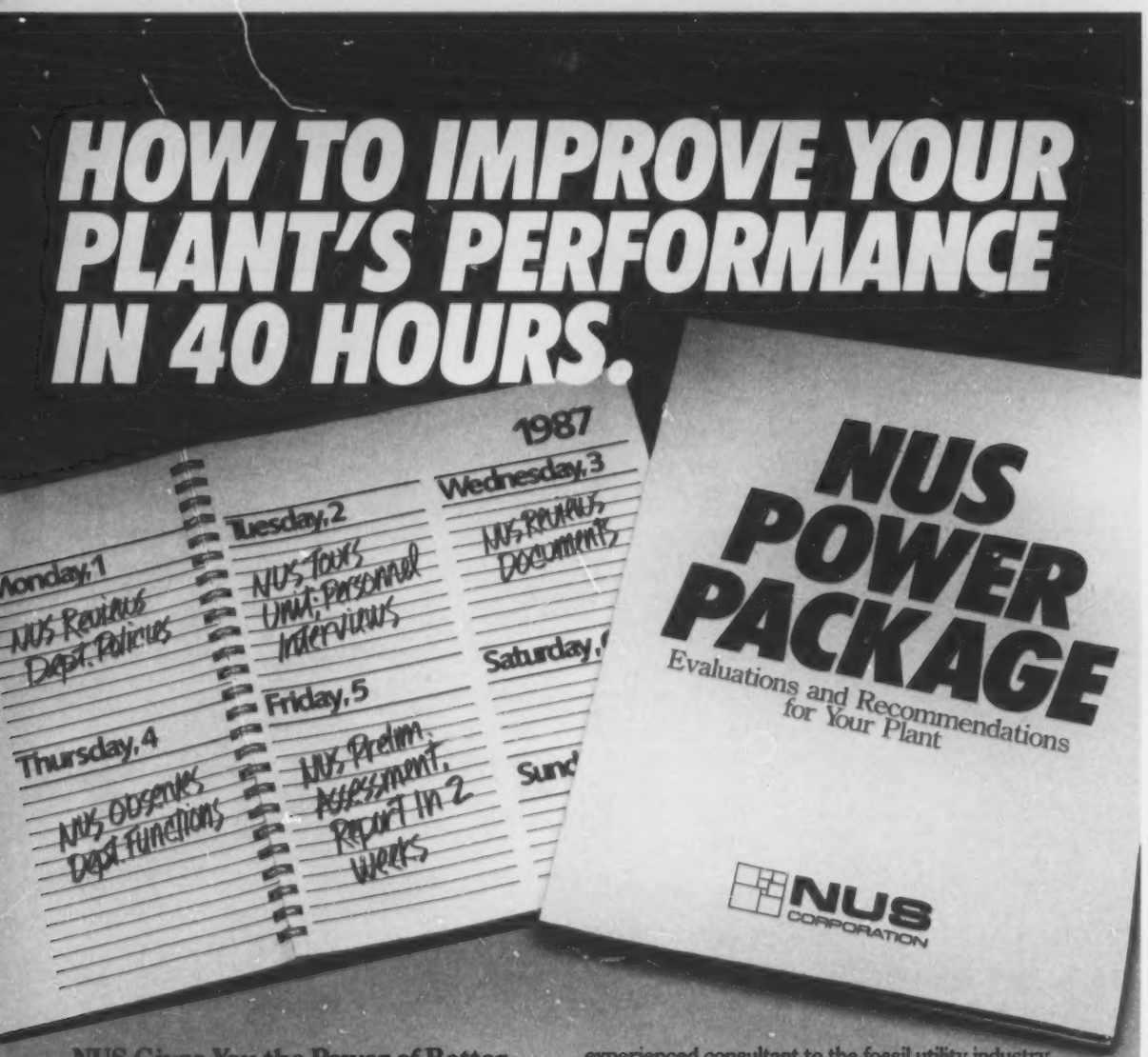
Traditionally, managements and unions have approached shiftwork problems with solutions incorporating monetary sweeteners, such as shift differentials, Sunday rates and call-back pay. Unfortunately, most shiftworkers merely pocket the money and continue to dream of a day job.

At some point, management may sense that the money is of little value. For example, the highest shift differential we have ever seen is $1 per hour. When this point is reached, a vice president is likely to ask the plant manager "what are we getting for this premium?" The answer, usually, will be "not much." The core of the problem remains the schedule and solution really lies in developing a better shiftwork program.

There are a variety of schedule models and countless variations of each model. The most common in use today was originated during World War II. It is the 28-day cycle, involving four-crew weekly rotation (often enhanced with a fifth crew for relief).

Among more modern schedules we have found several models that come much closer to matching operational needs, employee preferences and circadian rhythms. In all cases, the schedule is built around a 168-hour work week, with time-off provided within crew assignments. The three-crew, eight-hour schedule provides maximum flexibility for increased training, unlimited personal days and improved alertness. The integrated five-crew, eight-hour schedule with employee incentives for coverage reliability provides the equivalent of ten weeks vacation while reducing overtime and providing reliable manning and coverage of all functions. The 12-hour, slowly rotating schedule with a 40-hour workweek reduces built-in overtime, improves time off and is fairly easy for the employees' bodies to adjust to.

In summary, if the thought of entrusting millions—even billions—of dollars of capital facilities and equipment to a group of chronically fatigued shiftworkers is keeping you awake nights, then you should look to see if your shift scheduling doesn't need updating. You really shouldn't be operating your modern, up-to-date generating plants on a 1940-era shift schedule. There are a variety of solutions to the problem.


**NUS Gives You the Power of Better Planning For One Low Price**

Take control of your plant's performance with the NUS Power Package℠. Designed specifically for fossil utilities, the Power Package℠ includes the objective evaluations and expert recommendations you need to improve unit performance.

In just 40 hours, an NUS fossil specialist has all the vital data down on paper for any one of four key programs—***operations, maintenance, chemistry, training.*** And all at one low, fixed price. No contingencies. No add-ons. Just answers that tell you how to improve your plant's performance quickly and effectively.

NUS has been bringing fossil utility managers in-plant expertise and support for over 10 years. As an experienced consultant to the fossil utility industry, we understand your business, your plant life extension programs, and your drive for efficiency. Our services include procedures preparation, customized training, maintenance planning, chemistry assistance, as well as quick response to time-sensitive projects.

With the NUS Power Package℠, you get the answers you need to improve your plant's performance. Call or write today for a free, no obligation proposal. ***1-800-233-7299.*** NUS Corporation, Field Operations and Training Division, 910 Clopper Road, Gaithersburg, MD 20878-1399.

NUS CORPORATION

© 1987 NUS CORP.

Inquire R.S. 22


## Longer cycles . . . from page 25

age refueling outage days for boiling water reactors (BWRs) on long cycles are 183.5, compared to 120.6 for plants on 12-month refueling schedules. But for PWRs, the long-cycle refueling outages have averaged 108.9 days, compared to 80.7 days for plants on 12-month schedules. In other words, the actual outage increase observed for some long-cycle PWRs still validates the original premise of the 18-month cycle.

*The reason for the poor performance of 18-month fuel-cycle plants is other scheduled outages.*

Recent analysis of Westinghouse plants' critical path days for activities directly related to refueling—reactor disassembly, fuel movement, etc.—shows that the average Westinghouse plant used 11.6 days of critical-path refueling activities in 1985, and that they increased to 20.3 days in 1986.

The actual plant-specific reasons for reduced availability vary considerably from plant to plant. The list of causes is long and complex. It also varies from year to year. The additional steam-generator availability has been overshadowed by increases in other factors.

The significant aspect of this is that there is no single overriding factor that will prevent the industry from achieving the reduction in total outage time necessary to make the extended fuel cycle decision pay off.

### Improved PM needed

The challenge facing the industry will ultimately distill the need to improve all facets of plant preventive maintenance.

Clearly, standard inspection criteria for wear, percentages of system to be inspected and amounts of spares to be stocked all are variables that must be reevaluated and expanded when extended fuel cycles are utilized. New industry advances in diagnostics—for example, Westinghouse systems such as GeenAID, TurbinAID and ChemAID—can provide some much-needed intelligence.

Additionally, integrated outage management programs that focus on improved maintenance planning procedures and techniques, including critical parts analysis, have made measurable improvements in performance at plants such as Farley and Salem, among others. In summary, although current data on availability are discouraging, it is not necessarily a permanent trend. Extended fuel cycles can improve plant availability. But it will not happen automatically...nor will it be easy.

Volume 65, Number 9
September 1987

# Electric Light & Power

THE NEWS MAGAZINE OF ELECTRIC UTILITY MANAGEMENT AND TECHNOLOGY

A PENNWELL PUBLICATION

## Records are broken all over

Henry Stein
Engineering Editor

It has been a month of record shattering for the electric power-producing industry. All over the country, demands hit new highs in June and July, as reported to *EL&P* by a number of electric companies.

On the "other side of the coin", the Edison Electric Institute noted that the week of July 25, 1987, topped the previous year's high for generated output by 5.7 percent with a whopping 60,564 GWh. (The previous high of 57,324 GWh was exactly a year ago, over the week of July 26, 1986.)

As if this was not bad enough, the week ending August 8th saw output go up again, to 60.7-billion kWh. EEI attributes the peaks to weather conditions, but also to economic growth in the United States.

### New highs listed

Some examples of the new demand highs in 1987 from the utilities follow:

- On June 16th, Indianapolis Power & Light had an all-time, one-hour system peak of 2,199 MW.
- On July 9th, General Public Utilities reached a new high of 6,807 MW at 2:00 PM. And GPU's Metropolitan Edison hit a new high of 1,562 MW at the same time on the same day.
- Consumers Power set a record of 5,402 MW between 1:00 and 2:00 PM on July 20th. The utility's reserve margin fell to 12.5 percent, well below the electric power industry's standard of 22 percent. Said Gordon L. Heins, vice president of fossil and hydro operations, "This new peak arrived three years earlier than our own projections."
- In Chicago, Commonwealth Edison customers topped out at 15,367 MW on the same day. As if this wasn't enough, they went on to set a new demand record of 15,683 MW on August 3rd. John Hogan, an Edison spokesman, couldn't resist pointing out that both of these peaks surpassed a projection made in 1984 by the Business & Professional People for the Public Interest (BPI) to the Illinois Commerce Commission. In supporting a statement that Edison's newest generating units were unnecessary, BPI forecast that the peak reached on July 20th would not be needed until the year 2006.
- United Illuminating topped out on the fourth day of a five-day heat wave with a peak of 1,036 MW on July 24th. The New England Power Pool recorded a new summer peak of 17,059 MW for the six-state region. In addition to using its complete generating capacity, UI invoked all the demand-limiting techniques that were available.

### Red-letter day

- And July 30th was a red-letter day for Missouri Public Service, with a load of 837 MW at 6:00 PM. That was 46 MW more than last year's (record) peak of 791 MW, which was also set on a July 30th.

## PSNH teeters near bankruptcy; won't provide new services

MANCHESTER, NH—Public Service Co. of New Hampshire, weakened by continuing delays in obtaining an operating license for its Seabrook nuclear station and shut off from any new funds from Wall Street, moved closer to bankruptcy in late summer.

Requesting a $71-million (15 percent) emergency rate increase, the company said it may become the first utility since the Depression to seek bankruptcy protection. Although the company admitted it probably has enough cash to meet its normal requirements through the end of the year, it warned that it may be unable to pay a $40-million interest payment due October 1 on publicly-held debentures.

In addition, the company reported that it would not accept applications for new service after September 1. Without its requested rate relief, company President, Robert J. Harrison said PSNH no longer will be able to provide electricity to potential new customers in its rapidly growing service territory. The company simply is running out of money, he said.

PSNH's rate request would require regulators to accept part of the company's Seabrook nuclear plant investment in the company's ratebase. Since the plant is not operational, the New Hampshire Supreme Court would have to rule unconstitutional the 1979 state law that requires property to be "used and useful" before going into the ratebase. The utility has requested that the state PUC bring this question before the court.

About 27 percent of PSNH's investment in Seabrook would be reflected in the new rate, if approved by the commission. PSNH's total stake in the beleagured plant is 35.6 percent.

The company also is considering exchanging new securities for some outstanding debt. Although such a move will not be sufficient to ward off bankruptcy by itself, it could contribute to improved financial status in the future.

## Coming in October

T **********5-DIGIT 20814
C 410012729*090187T 000000*
C 0000
SUITE 800 COPY # 2 80057
CONGRESSIONAL INFO SERVICES
4520 EAST WEST HWY
BETHESDA MD 20814

*EL&P's* Electric Utility Caravan, a traveling trade show, provided an opportunity for more than 4000 utility and consultant/constructor engineers and operating personnel to see and discuss the product displays of 30 important suppliers to the electric utility industry on its five-week tour.

## EL&P Caravan completes successful East Coast tour

BARRINGTON, IL—*Electric Light & Power's* touring trade show, the *EL&P* 1987 Electric Utility Caravan, has completed its successful tour of East Coast utilities.

More than 4000 engineers and operating personnel toured the Caravan, viewing the displays and discussing the products of the 30 participating suppliers of equipment for the electric power industry.

The Caravan made 49 stops at the offices of Eastern electric utilities and major engineering consultants and constructors. Forty-six separate organizations were visited during the five-week tour.

The Caravan, which initially was conducted by *EL&P* for several years in the early 1970s, was conducted in conjunction with Mobil Marketing Services.

### High interest reported

Visitors to the Caravan, as well as exhibitors, expressed their pleasure with the Caravan and the quality of the displays.

An engineer for Potomac Edison said the Caravan "provides an excellent opportunity for our field staff and new engineers and others to become aware of what's new in our industry."

A New England Power Service Co. engineer expressed the hope that similar products would be exhibited on the Caravan's next visit.

An executive with Rochester Gas & Electric said, "I talked with several people who visited the vans and all found something of interest. Please let us know of your next Tour so we can be included."

Exhibitors also reported a high degree of satisfaction with their participation. Many reported not only top level contacts but said they had actually written orders on the spot. Others said they are responding now to requests for estimates, quotations and proposals.

### 1988 tour moved up

*EL&P's* 1988 Caravan tour, which was planned for the Fall next year, has been moved up to the Spring of 1988 as a result of the response of participants of the 1987 tour. Nineteen of the 30 1987 Caravan exhibitors already had signed up to participate in the 1988 tour, as of August 1.

The 1988 tour will visit utilities and architect-engineers from western Pennsylvania to Nebraska, and from Louisiana to the Canadian border.

Continued on page 3

## ASEA/Brown Boveri and PacifiCorp/Utah P&L mergers are signs of the times

Robert A. Lincicome
Editor-in-Chief

BARRINGTON, IL—Announcement of a plan to merge Sweden's giant heavy equipment manufacturer, ASEA AB, with Brown Boveri & Co., the big Swiss maker of heavy electrical apparatus, stirred both the electrical and financial industries in mid-August. That statement was followed close behind by announcement that the rumored merger of Utah Power & Light into PacifiCorp had been approved by both companies' boards of directors.

In the case of the ASEA/Brown Boveri merger, the result will be the creation of the world's largest heavy electrical apparatus supplier. For PacifiCorp/UP&L, the merger will create a utility that ranks 10th in terms of market value, 13th in kilowatthour sales and 22nd in terms of total capitalization.

Both mergers reflect financially strong, growing companies acquiring

Continued on page 6

# News Briefs

JILL MINNER, Assistant Editor

## Wisconsin Electric asks PSC to approve rate decrease

● Wisconsin Electric Power Company (WE) has asked the Wisconsin Public Service Commission to approve its request for a 1.4 percent decrease in electric rates. WE said the decrease, which would total about $14.3 million, is possible because of lower-than-projected fuel costs, renegotiation of coal transportation contracts and reductions in the cost of purchased power. "We want to pass along to our customers as soon as possible the fuel cost savings we've been able to realize," stated WE Executive Vice President Tom Cassidy. The company's goal, Cassidy added, is to be the least-cost provider of quality energy services in the Midwest.

## NCA predicts U.S. coal use will continue to increase in 1987

**Electric Utilities Percent Generation By Fuel**

| | Coal | Oil | Natural Gas | Nuclear | Hydro | Electricity Growth Rate |
|---|---|---|---|---|---|---|
| 1984 | 55.5 | 5.0 | 12.3 | 13.6 | 13.3 | 4.6 |
| 1985 | 56.8 | 4.1 | 11.8 | 15.5 | 11.4 | 2.2 |
| 1986 | 55.7 | 5.5 | 10.0 | 16.6 | 11.7 | 0.7 |
| 1987 | 55.3 | 5.3 | 9.8 | 17.6 | 12.0 | 2.0 |

*Source: National Coal Association*

● In its midyear review of coal markets, the National Coal Association (NCA) predicts that overall U.S. coal production and consumption in 1987 will be slightly higher than in 1986. Bituminous coal and lignite production is estimated to reach a record 897 million tons by the end of the year, and consumption should grow to 892 million tons, according to the forecast. Electric utilities are expected to use 694 million tons of coal this year, 9 million tons more than in 1986. However, NCA said coal's percentage of the generation market will decrease to 55.3 percent, down from 55.7 percent in 1986 (see table). The decrease is a result of more nuclear capacity coming on line in 1987, according to the association. NCA forecasts that overall electricity generation will rise 2 percent this year, with slightly lower growth occurring in the Midwest, and higher growth taking place in New England, the South and Southwest.

## DOE designates October as Energy Awareness Month

● The Department of Energy (DOE) has scheduled its Seventh Annual National Energy Awareness campaign, *"Energy Security: Our Future Depends On It"*, for the entire month of October. In conjunction with Energy Awareness Month, the Federal Energy Management Program Awards and the Energy Innovation Awards will be presented by Secretary of Energy John S. Herrington. Campaign activities are being coordinated by DOE in cooperation with a steering committee. Organizations planning energy awareness activities or those interested in participating should contact Connie Boggs, DOE Division of Public Affairs, CP-24, MS 1E-200 FORSTL, U.S. Department of Energy, Washington, DC, 20585, or call (202) 586-6827.

# In This Issue


**Editorial** ..... 4

**SoCalEd** carefully reappraises the role of alternative power sources. ..... 7

**Calendar** ..... 10

**Generation Update** ..... 13

**New designs and new materials** meet the industry's evolving needs for controlling liquids and gases.**G** ..... 15

**Swing-check valves** must be selected on a case-by-case basis for them to do their jobs properly.**G** ..... 15

**Solenoid valves** provide the power to remotely handle big and small flows, high and low pressures.**G** ..... 16

**Asbestos is on the way out** and new materials are on the way in as far as suppliers and users are concerned.**G** ..... 16

**Motor-operated valves** have to be carefully installed and maintained in nuclear plants for obvious reasons.**G** ..... 17

**Transmission and Distribution Update** ..... 21

**EL&P previews underground equipment** introduced since last year's IEEE T&D show.**T/D** ..... 23

**Readers' Service** ..... 29

**New Products** ..... 31

**Personnel** ..... 34

**Bulletin Board** ..... 35

**Management Methods** ..... 39


**EL&P readers whose responsibilities include both Generation and Transmission/Distribution receive both technology sections. Other readers receive the technology section that applies to their respective area of responsibility. The Generation edition is indicated by a single dot (•) in the upper right corner of page 1; the T/D edition carries two dots (••). All readers receive EL&P's industry news section.**

## Republic of China inks $90M contract with Foster Wheeler

● According to Foster Wheeler Corporation, members of the 1987 Special Procurement Mission of the Republic of China recently signed a $90-million contract for two Foster Wheeler steam generators. The 550-MW units are to be used at the Taichung Power Project in Taiwan. Foster Wheeler said the contract, announced earlier this year, symbolizes the Republic of China's efforts to improve the balance of trade with the United States.

## Niagara Mohawk Power Corp. eliminates 389 positions

● In an effort to reduce costs, Niagara Mohawk Power Corporation has abolished 389 jobs from its 8,400-member work force. The utility said, however, that the action only effects 149 employees because 240 of the jobs being eliminated are already vacant. Perry B. Woods, Jr., vice president-employee relations, said that the company's union workers recently voted down a management proposal to defer for 12-months a 4.5 percent wage increase. "That proposal also included a guarantee of no layoffs for union employees," Woods stated, "...[the union employees] understood when they voted that some people could lose their jobs as a result as we seek our goal of cutting our costs by $100 million in 1988." Woods added that further cuts will be necessary in the months ahead.

## AIF merges with U.S. Council for Energy Awareness

● As part of a major industry reorganization, the Atomic Industrial Forum, Inc. (AIF) said it has been merged with the U.S. Council for Energy Awareness, Inc. (USCEA) to form a new USCEA. The new organization will combine the traditional AIF information functions with the advertising and public affairs outreach programs of the old USCEA, according to AIF. Current AIF President William J. Dircks will take the position of deputy director general for administration of the International Atomic Energy Agency in Vienna, Austria, on January 1, 1988. AIF expects the physical merger of the groups to be completed later this year.

## NIPSCO celebrates 75th anniversary

Northern Indiana Public Service Company (NIPSCO) observed its 75th anniversary as a state corporation last month. NIPSCO, originally known as the Calumet Electric Company, started out serving the areas of Gary, Valparaiso and La Porte and today is the state's largest electric and gas utility, according to the company. Construction of NIPSCO's first generating unit (shown above) at the Michigan City Generating Station marked the beginning of an ambitious building program for the company in the 1930s.

## Free cogen studies available to Atlantic Electric customers

● Atlantic Electric said it is offering a free feasibility study to its commercial and industrial customers who are interested in investigating their cogeneration potential. "The goal of the feasibility studies is to assess a customer's potential for cogeneration and provide them with a cost analysis for such a project," explained Meredith I. Harlacher, Jr., vice president of customer service. The studies, to be conducted by Concept Technology, Inc., will consider variables such as the customer's electrical and thermal loads and available space for locating equipment. A written analysis detailing total capital costs, net present value, cash flow analysis and return on investment will be provided for each customer, according to the utility. "As our cogeneration consultant," Harlacher explained, "Concept Technology will be expected to draw a conclusion from the study, suggesting a course of action to our customer." Concept Technology is a Princeton, New Jersey-based energy engineering firm that develops packaged cogeneration systems.

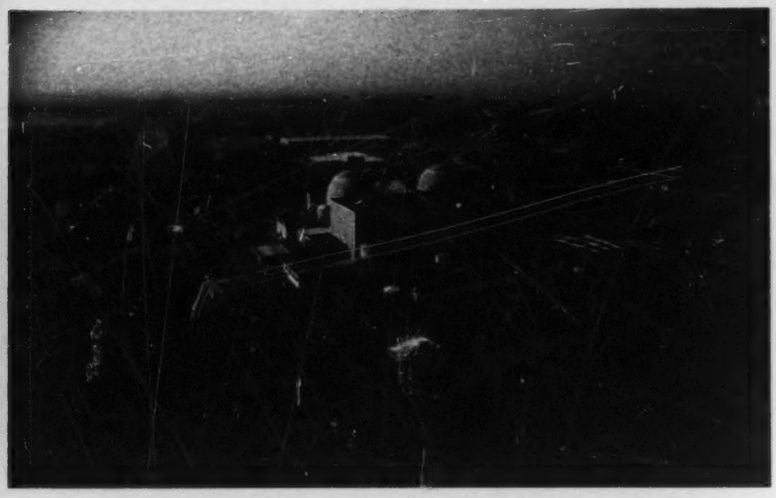
10/7/87 C6985-6

Volume 65, Number 10
October 1987

# Electric Light & Power

THE NEWS MAGAZINE OF ELECTRIC UTILITY MANAGEMENT AND TECHNOLOGY

A PENNWELL PUBLICATION



## *Focus on solutions to industry problems*

Reverse osmosis, long used to remove inorganic materials from makeup water, in a technological turnaround now is used to remove organic materials at Virginia Power's North Anna nuclear station. Solutions to water problems are discussed in the Generation Focus Report, p.26. A T/D Focus Report on Brush Control technology begins on p.32.

## No evidence PCBs lead to cancer: joint industry study

WASHINGTON—A new jointly sponsored study of biological data on the effects of polychlorinated biphenyls (PCBs) challenges the widespread belief that these substances are highly toxic to humans and can cause cancer.

The study was conducted by independent toxicology consultants from the University of Arkansas medical school. It was sponsored by the National Electrical Manufacturers Association, Chemical Manufacturers Association and the Utility Solid Waste Activities Group.

### Research review

The consultants reviewed data obtained in previous research studies and concluded that the data do not indicate that PCBs are a probable cause of cancer in humans. Existing evidence, they say, is inadequate to confirm PCBs as being carcinogenic.

They report that epidemiological studies of worker populations that were highly exposed to PCBs have shown no consistent cancer increase that can be attributed to PCB exposure. The three consultants, Drs. Raymond D. Harbison, Robert C. James and Stephen M. Roberts, all of the division of interdisciplinary toxicology at the U. of A. medical school, conclude that PCBs are non-mutagenic—that is, they do not cause mutations in cells.

Animal studies reviewed by the consultant team show no more than limited, inconclusive evidence that PCBs cause cancer in animals, except in studies where highly chlorinated (60 percent chlorine) PCBs were used.

### Sent to California Panel

A Scientific Advisory Panel established under California's Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) currently is reviewing candidate chemicals for possible regulation under the Act. The consultants' reports were furnished to the panel for consideration in its review of PCBs.

The letter forwarding the study to panel members states that "the evidence from animal studies does not justify regarding all PCBs as carcinogenic to humans." The letter went on to say that human health-effect studies "do not reflect any statistically significant human cancer effects resulting from PCB exposure."

The letter also cited other recent studies supporting the consultants conclusions. These include a study of environmental exposure to PCBs in New Bedford, MA, and a study of occupational exposure to PCBs from Hudson River sediment.

### Copies available

Copies of the study, "Biological Data Relevant to the Evaluation of Carcinogenic Risks to Humans," are available from Dr. Douglas G. Bannerman, Environmental Consultant, NEMA, 2101 L Street NW, Washington, DC 20037.

**********5-DIGIT 20814
4100127299 1001877 0000009
0021
SUITE 800 COPY # 2 80147
CONGRESSIONAL INFO SERVICES
4520 EAST WEST HWY
BETHESDA MD 20814
Transformers

## SMUD for sale? PG&E, Duke may be interested

SACRAMENTO, CA—Sacramento Municipal District, one of the country's largest municipal utilities, is "exploring the issue of divestiture," and has corresponded with two of the largest investor-owned utilities, according to a SMUD spokesman.

Neighboring Pacific Gas & Electric Co. and Duke Power, headquartered in Charlotte, NC, are the two utilities that have expressed interest in SMUD or part of the California municipal.

SMUD is looking at alternatives to maintaining the *status quo*, including selling the entire system, because of mounting difficulties in dealing with a $1.4-billion debt and a troubled, non-operational nuclear power plant.

Controversy and questions have arisen, including the relative value of the idle Rancho Seco nuclear plant, regulations involving divestiture and SMUD's responsibility to the public it serves.

SMUD had solicited proposals and ideas from major organizations, including a half-dozen utilities, about buying, leasing or operating Rancho Seco. The response will be evaluated in a mid-October staff report to the SMUD board of directors.

And in June 1988, the question of whether or not to close Rancho Seco will come before district voters, put on the ballot by a local anti-nuclear group.

### Package deal?

PG&E recently proposed purchasing SMUD facilities in a comprehensive package that includes permanently closing Rancho Seco, which represents generation capacity PG&E doesn't need, but is bound by contract, to buy until 1989 if the plant operates under SMUD. Rancho Seco has been closed since a December 1985 emergency shutdown.

SMUD is spending $120 million this year to restart the plant by January 1988. This investment is in addition to the $120 million a year normally required to maintain the plant, explained Kerry Shearer, a SMUD spokesman. Additional funds to increase plant efficiency also are slated for the 1988 budget, now being drafted, he said.

### PG&E's consolidation offer

The PG&E proposal satisfies SMUD's objectives, suggested David Monfried, PG&E spokesman. But views differ on a number of points, including Rancho Seco.

The PG&E plan proposes to:

- Purchase all property and facilities for a set price, subject to negotiation. With more than 100 years of natural gas service to the Sacramento area, PG&E wants to expand electrical distribution to SMUD's 410,000 customers. PG&E now has about 3.9 million electric- and 3.2 million natural gas-customers in a territory covering most of northern and central California.
- Close Rancho Seco, which accounts for 54 percent of SMUD's generating resources. With its recent start of the Diablo Canyon nuclear units, PG&E has an excess of power generation capacity and does not need, nor want, the additional capacity that Rancho Seco could offer. Estimated decommissioning costs range from $600 million by SMUD to at least $220 million by PG&E, yet PG&E would shut it down.

"It's not economically sound to operate the plant, whether it's Duke, SMUD or anyone else," Monfried said.

Shearer said he didn't know if the differing opinion of the plant's usefulness would affect SMUD's views about the total PG&E proposal.

- Freeze electric rates for several years. This would be a definite bonus to Sacramento consumers, who have seen recent rate increases associated with Rancho Seco costs. Shearer questioned how a freeze could be guaranteed since the Public Utility Commission sets rates.
- Provide job security for current

Continued on page 17

## *Underwriters to pay $92-M to holders of WPPSS securities*

NEW YORK—Four underwriters of now-defaulted bonds issued by the Washington Public Power Supply System have agreed to a $92-million settlement of a class-action suit. This is the first settlement in claims against WPPSS, underwriters of its debt and others involved in WPPSS' $2.5-billion default, the largest in history, in mid-1983. A number of other suits are pending.

The four lead underwriters who agreed to the settlement were Merrill Lynch & Co., Solomon Brothers Inc., Smith Barney, Harris Upham & Company and Prudential-Bache Securities, Inc.

The suit resulted when WPPSS defaulted on $2.25-billion of securities after cancelling construction of Units 4 and 5 in its ambitious nuclear program. Member public power organizations refused to honor agreements to pay WPPSS for the cancelled units under take-or-pay contracts after the Washington State Supreme Court ruled them invalid.

Bondholders sued on the grounds that they were misled by official statements about the risks inherent in the securities.

The settlement, which will consist of a payment of $80-million plus interest at 10 percent for up to 18 months, still must be approved by a federal court. After that, legal fees and expenses will be paid out before proceeds are distributed to bondholders.

A jury trial involving all remaining defendents is scheduled to begin in September 1988.

# News Briefs

JILL MINNER, Assistant Editor

## NIPSCO will propose holding company plan to shareholders

● According to Northern Indiana Public Service Company (NIPSCO), its board of directors has approved a plan to exchange common shares with a new holding company for NIPSCO and NIPSCO subsidiaries, and has also reinstated the common dividend. "The reinstatement of the common stock dividend has been a high corporate priority of the board of directors for many months," stated NIPSCO Chairman and CEO Edmund A. Schroer, "The board believes that major uncertainties affecting the company have been resolved, and is pleased to be able to take this step." Under the new holding company proposal, which will be presented to NIPSCO shareholders for a vote later this year, NIPSCO common shareholders would be solicited to exchange their shares for common shares of the new holding company on a one-for-one basis. If the plan is approved, NIPSCO said it would become a wholly-owned subsidiary of the holding company.

## Niagara Mohawk's Nine Mile Point 2 begins supplying power

● New York State Electric and Gas Corporation reported that Niagara Mohawk Power Corporation's Nine Mile Point 2 nuclear power plant has started producing electricity. Nine Mile-2 was operating at about 15 percent of its total capacity when it first began supplying power, the utility said. Niagara Mohawk expects the 1,080-MW plant to begin full operation in early 1988.

## UDI ranks Maine Yankee plant as lowest-cost producer in 1986

● A report conducted by Utility Data Institute, Inc. named Maine Yankee Atomic Power Company's Maine Yankee plant as the nation's lowest-cost producing nuclear power plant in 1986. Maine Yankee said its plant produced electricity at two cents a kilowatt hour, including funds for decommissioning and disposal of spent nuclear fuel. According to Maine Yankee President Charles E. Monty, 1986 was the best production year ever for the plant since it began operations in 1972.

## Detroit Edison buys Pontiac territory from Consumers Power

● Consumers Power Company has agreed to sell its Pontiac electric distribution service territory to The Detroit Edison Company for $10.25 million, according to the utility. Under the agreement, Detroit Edison will serve the 7.5-square-mile area after operations have been transferred. Currently, Consumers Power provides Pontiac customers with electricity purchased wholesale from Detroit Edison. Consumers Power said its natural gas customers in Pontiac will be unaffected by the sale.

# In This Issue


**Editorial** ..... 4
**Letters** ..... 4
**Conversion to AM/FM systems** can produce big savings and improve overall productivity ..... 15
**Calendar** ..... 19
**Generation Update** ..... 22
**Reverse osmosis** removes organics from nuclear plant make-up water in technological turnaround ..... 26
**Utilities can control Asiatic clams** in power plant cooling systems with a new molluscicide ..... 26
**Zinc treatment** can cut corrosion in power plant cooling systems ..... 28
**Transmission and Distribution Update** ..... 30
**Line worker safety** is best learned from visual aids that illustrate the do's and don'ts T/D ..... 32
**Diesel engines** just may be the future of powering trucks used for T&D line maintenance/repair.T/D ..... 33
**Brush management with herbicides** can extend time between treatments and between mechanical trimmings.T/D ..... 33
**Tree-growth regulators** can slow development of the trunk and branches enough to give large savings.T/D ..... 34
**Readers' Service** ..... 37
**New Products** ..... 39
**New Literature** ..... 42
**Regulatory Review** ..... 45
**Personnel** ..... 46
**Management Methods** ..... 47


EL&P readers whose responsibilities include both Generation and Transmission Distribution receive both technology sections. Other readers receive the technology section that applies to their respective area of responsibility. The Generation edition is indicated by a single dot (•) in the upper right corner of page 1; the T/D edition carries two dots (••). All readers receive EL&P's industry news section.

## Consumers Power phases out capacitors containing PCBs

● Consumers Power Company announced that it has phased out pole-mounted electric capacitors containing polychlorinated biphenyls (PCBs) more than a year ahead of the Environmental Protection Agency's (EPA) October 1, 1988 deadline. "The completion of Consumers Power Company's PCB capacitor phaseout program 14 months ahead of EPA's schedule is part of our continuing effort to minimize the presence of PCBs in our electric distribution system," said Rann C. Lincoln, vice president of distribution operations for the utility. As of August 1, 1987, the company said it replaced approximately 11,000 of the capacitors from its 27,800-square-mile overhead electric system. Consumers Power began its accelerated capacitor replacement program in 1983.

## WE signs letter of intent to purchase Presque Isle power plant

● Wisconsin Electric Power Company (WE) has signed a letter of intent with The Cleveland-Cliffs Iron Company to buy the Presque Isle power plant and related facilities for $247.5 million, according to the utility. "Adding the Presque Isle plant to our system will give Wisconsin Electric more flexibility in meeting customer demand for electricity," stated WE Chairman Charles McNeer, "And, because this purchase of an operating power plant is less expensive than new construction, we'll be able to continue to provide low-cost energy in years to come." WE expects to close the sale of the 600-MW coal-burning plant by the end of the year.

## NRC authorizes full power license for Beaver Valley Unit 2

● The Nuclear Regulatory Commission Office of Nuclear Reactor Regulation has granted Duquesne Light Company a full power operating license for Unit 2 of its Beaver Valley power station. At full power, NRC said the unit will have an electrical output of approximately 836 megawatts. Other owners of the power station include Cleveland Electric Illuminating Company, Ohio Edison Company and Toledo Edison Company.

## ICC denies second ComEd request for rate freeze settlement

● The Illinois Commerce Commission (ICC) has again denied Commonwealth Edison's request for a rate freeze settlement agreement, voting 4-3 not to relitigate the case. Edison's rate freeze proposal called for a one-time net average cost increase of 9.6 percent, followed by a minimum five-year freeze on additional rate increase requests. The utility had also proposed a traditional 27 percent rate increase which, Edison said, it may be forced to pursue.

## CL&P plans to pursue divestiture of gas business

● Northeast Utilities announced that its affiliate, The Connecticut Light and Power Company, is pursuing a voluntary divestiture of its gas business in order to avoid being in conflict with the Public Utility Holding Company Act of 1935. Philip T. Ashton, senior vice president and general manager-gas group, explained that once the work plan is developed, and if no significant feasibility complications arise, actual divestiture probably would take two to four years to accomplish. He added that the present management of the gas group will remain the same.

## Potomac Edison's computer classroom visits service areas

● As part of an economic development program, Potomac Edison Company's new mobile computer classroom is traveling throughout the utility's service territory to demonstrate the possibilities of computer-interactive instruction. The van, equipped with 28 Apple IIGS computers, the Digicard Classroom Network and Imagewriter II printers, was created in response to the results of a report conducted by the National Task Force on Educational Technology. "Research shows that computer-interactive instruction conveys ideas to students better than traditional blackboard instruction," stated Potomac Edison Coordinator Todd Stockslager, "Schools can use this computer network as a teaching tool for any subject matter, and it's an innovation that educators and communities will become excited about once they see it in use." Joint sponsors of the van include Apple Computer and Major Educational Resources.

# EIA: more oil imports, nuclear use due in '88

WASHINGTON—U.S. dependence on foreign oil will increase in 1988, reaching the highest level since 1980, as domestic crude oil production continues to decline, according to the Energy Information Administration's (EIA) latest *Short-Term Energy Outlook*.

Net imports will reach six million barrels per day in 1988, a 6-percent increase over the predicted 1987 rate of 5.6 million barrels per day. Utilities, though, will produce 1.16 quadrillion Btu from oil in 1988, 11 percent less than the projected 1987 figure of 1.3 quadrillion Btu, the organization said. (See table.)

**Total U.S. Energy Consumption in Quadrillion Btu**

| Source | 1979 Q | % | 1986 Q | % | '87 proj. Q | % | '88 proj. Q | % |
|---|---|---|---|---|---|---|---|---|
| Petro. | 37.1 | 47 | 32.2 | 44 | 32.3 | 43 | 32.4 | 42 |
| Gas | 20.7 | 26 | 16.5 | 22 | 16.4 | 22 | 17.1 | 22 |
| Coal | 15.0 | 19 | 17.3 | 23 | 17.5 | 23 | 17.9 | 24 |
| Nucl. | 2.8 | 4 | 4.5 | 6 | 5.0 | 7 | 5.3 | 7 |
| Hydro. | 3.1 | 4 | 3.4 | 5 | 3.3 | 5 | 3.5 | 5 |
| Other | 0.2 | * | 0.2 | † | 0.2 | † | 0.2 | † |
| TOTAL | 78.9 | 100 | 74.1 | 100 | 74.7 | 100 | 76.4 | 100 |

* Less than 0.2 percent
† Less than 0.3 percent

(Source: EIA's *Short-Term Energy Outlook*.)

### Utility segment

Utilities will use 3 percent more coal for generation in 1988, 2.81 quadrillion Btu compared to 2.73 quadrillion Btu projected for this year. Nuclear electricity production will increase by 6 percent in 1988 to 5.32 quadrillion Btu, up from a projected 4.98 quadrillion Btu this year. Gas will drop from the 1987 figure of 2.8 to 2.73 quadrillion Btu in 1988. Hydroelectric and other sources increase slightly from the 1987 level of 0.27 to 0.28 quadrillion Btu in 1988, the report said.

EIA also expects crude and petroleum product stocks to drop by 29 million barrels during 1987, but to remain stable at the end of 1988. Total petroleum demand, in 1988, will level off at about 16.4 million barrels per day.

### March report

These figures are in line with a March report by Energy Secretary John S. Herrington, which predicted oil imports would reach 8- to 10-million barrels a day in the 1990s. More than 40 percent of U.S. energy now comes from oil.

### More coal, nuclear consumption

Other findings in the EIA outlook include the following:

- With the increased residual fuel oil prices, the sharp rise in residual fuel demand in 1986 is already reversing itself in 1987, and a decline of 200,000 barrels per day is projected for the entire year. Most of the drop is in the electric utility sector, said EIA, with further losses expected in 1988.
- Eleven nuclear units, starting operation in 1987 and 1988, are expected to increase the nuclear share of electricity generation to 19 percent in 1988, with total generation increasing by 2 percent this year and 2.5 percent in 1988.
- U.S. energy consumption in 1988 could reach the highest level in nine years at 76.4 quadrillion Btu, compared to 78.9 quadrillion Btu in 1979. Petroleum, however, comprised 47 percent of 1979 consumption compared to 42 percent for 1988. Coal and nuclear power accounted for 22 percent of energy consumption in 1979, but more than 30 percent as projected for 1988.

### Copies of the report

Copies of the *Short-term Energy Outlook* are available from the U.S. Government Printing Office or through EIA's National Energy Information Center (NEIC), Room 1F-048, Forrestal Building, Washington, DC, (202) 586-8800.

# *Utility efficiency drops, according to NARUC report*

WASHINGTON—All but two of the top 113 investor-owned utilities were less productive in 1985 than in 1972, according to a recent report from the National Association of Regulatory Utility Commissioners (NARUC).

NARUC's *Electric Utility Performance Study 1972-1985* is based on 14 years of data electric companies have provided the Federal Energy Regulatory Commission.

In three sections, the report ranks financial performance, percentage change for customer rates and productivity for the 113 largest electric utilities in the country. (See tables.)

Although total productivity has gone down, "The financial health of the industry has improved each year since 1980," according to Michael Foley, director of financial services and author of the report. Foley said utilities recently have seen more cash earnings each year, along with a stabilization of rate increases.

The widespread drop in productivity still is a major cause for concern, Foley suggested.

Productivity changes were based on an index called Total Factor Productivity (TFP), calculated by dividing kilowatthours sold by a series of inputs, such as invested capital, fuel, labor and purchased power.

The TFP index measured the change in productivity over the 14-year period, not actual productivity. This means that the highest-ranked firm may have started the study period at a much lower productivity level, so its actual productivity could be less than lower ranked companies. Similar observations may be made about the firms with the greatest decrease in productivity.

Using this measure, the study concludes that just two companies increased productivity, while all others decreased between 2.4 percent and 58.7 percent. Central Power & Light Co. and Otter Tail Power Co. showed gains, while Portland General Electric Co. had the largest decrease.

The decrease of productivity over the past decade is cause for alarm and a topic for more research, said Foley. Means of increasing productivity, such as greater efficiency and lower construction costs, are vital, he suggested.

**Strongest financial performers**

| Company | Rank |
|---|---|
| Wisconsin Electric Power | 1 |
| Wisconsin Public Service | 2 |
| Black Hills Power & Light | 3 |
| Southern Indiana Gas & Electric | 4 |
| Iowa Southern Utilities | 5 |
| Louisville Gas & Electric | 6 |
| West Pennsylvania Power | 7 |
| Hawaiian Electric | 8 |
| Southwestern Electric Power | 9 |
| Wisconsin Power & Light | 10 |

**Weakest financial performers**

| Company | Rank |
|---|---|
| Detroit Edison | 113 |
| Western Mass. Electric | 112 |
| Philadelphia Electric | 111 |
| Boston Edison | 110 |
| Alabama Power | 109 |
| Consumers Power | 108 |
| Kansas Gas & Electric | 107 |
| Jersey Central P&L | 106 |
| Savannah Electric & Power | 105 |
| Commcnwealth Edison | 104 |

Financial performance was based on 10 indicators which emphasize the relative importance of the firm's cash flow. The indicators include: long-term debt ratio, return on equity, pre- and post-tax interest coverage ratio and Allowance for Funds Used During Construction (AFUDC) divided by net income. Foley explained that the higher the ratio of non-cash earnings, the weaker the company is.

According to the model, the utility ranked first for financial performance over 14 years was Wisconsin Electric Power Co., while the weakest was Detroit Edison.

The study compiled tables ranking rates charged to residential, commercial and industrial customers, overall average retail rates, average revenue per kwh during each year and the percentage of rate increases from 1980 to 1985 and from 1972 to 1985.

Residential users of the average electric utility experienced rate increases of approximately 220 percent over 14 years compared to a 157-percent increase in the consumer price index.

The highest residential rate increase over the 14 years was attributed to San Diego Gas & Electric Co. at 445 percent; the lowest was Montana Power Co. at 89 percent.

Copies of the 69-page study are available for $30 each from NARUC, P.O. Box 684, Washington, DC, 20044.

**Highest Resid. Rate Increase**

| Company | % Inc. | Rank |
|---|---|---|
| San Diego Gas & Electric | 445.2 | 1 |
| Long Island Lighting | 363.3 | 2 |
| Houston Lighting & Power | 361.4 | 3 |
| El Paso Electric | 360.7 | 4 |
| Nevada Power | 349.3 | 5 |
| Central Hudson G&E | 347.6 | 6 |
| United Illuminating | 336.5 | 7 |
| Florida Power & Light | 331.9 | 8 |
| Orange & Rockland Utilities | 321.1 | 9 |
| Jersey Central P&L | 307.3 | 10 |

**Lowest Resid. Rate Increase**

| Company | % Inc. | Rank |
|---|---|---|
| Montana Power | 89.1 | 113 |
| Southern Indiana G&E | 107.7 | 112 |
| Minnesota Power & Light | 112.4 | 111 |
| Otter Tail Power | 124.9 | 110 |
| Indianapolis P&L | 129.3 | 109 |
| Idaho Power | 130.0 | 108 |
| West Penn Power | 131.0 | 107 |
| Monongahela Power | 132.1 | 106 |
| Iowa Southern Utils | 132.9 | 105 |
| Northern States Power | 136.1 | 104 |

**Greatest Increase in Total Factor Productivity**

| Company | % Inc. | Rank |
|---|---|---|
| Central Power & Light | +7.2 | 1 |
| Otter Tail Power | +0.5 | 2 |
| Southwestern Electric Power | -2.4 | 3 |
| Bangor Hydro Electric | -4.0 | 4 |
| West Texas Utilities | -5.3 | 5 |
| Long Island Lighting | -7.7 | 6 |
| P.S. of New Hampshire | -9.0 | 7 |
| Illinois Power | -9.4 | 8 |
| Central Maine Power | -9.8 | 9 |
| Kentucky Power | -14.5 | 10 |

**Greatest Decrease in Total Factor Productivity**

| Company | % Inc. | Rank |
|---|---|---|
| Portland General Electric | -58.7 | 113 |
| Central Illinois Light | -55.8 | 112 |
| Ohio Power | -55.5 | 111 |
| Northern Indiana P.S. | -54.8 | 110 |
| Duquesne Light | -53.8 | 109 |
| San Diego G&E | -52.6 | 108 |
| Indiana & Michigan Elec. | -50.5 | 107 |
| Madison Gas & Electric | -50.2 | 106 |
| Pacific Power & Light | -50.1 | 105 |
| Nevada Power | -49.8 | 104 |

(Source: NARUC's *Electric Utility Performance Study 1972-1985*.)

## NIPSCo gets OK for foreign financing

HAMMOND, IN—The Indiana Utility Regulatory Commission has approved Northern Indiana Public Service Company's request for permission to enter into a $70-million 5-year revolving underwriting agreement with a consortium of foreign banks.

The company will use the facility to cancel a similar loan agreement that would have matured next year.

Approval of NIPSCo's proposal allows the company to make full use of a $155-million revolving underwriting facility completed earlier. The earlier 5-year facility will be used to issue short-term notes in the European commercial paper market.

# Editorial

## Clean coal vs. scrubbing: Costly clean air Catch 22

The NOW generation of organized environmentalists is pushing hard to get stringent revisions to clean air legislation through Congress this fall. The goal is to reduce acid rain substantially, using current technologies. This means more scrubbers to remove more $SO_2$ from stack gases *after* combustion.

It also means utilities could see the present $10-billion tab for emission cleanup double over the next few years, and continue to climb thereafter.

Utilities, and others, favor cleaning the coal *before* combustion to eliminate not only the sulfur by-products, but other undesirable materials that contribute to acid rain, such as oxides of nitrogen, as well. Unfortunately, coal-cleaning technologies, while well-known generally, just are not commercially available today. Still, utility management contemplating the potential benefits of coal cleaning consider scrubbers to be technological dinosaurs, doomed to extinction. These coal-cleaning advocates would like to postpone further investment in scrubber technology because if coal-cleaning methods can be brought to commercial status in the next decade or so, none of today's scrubbers will be needed. This would reduce capital requirements and, ultimately, the cost of electricity to customers.

With the Senate likely to vote on a rewrite of the Clean Air Act before yearend, and the House working on its own version of acid-rain reduction legislation, it's no surprise the controversy is really heating up.

Utilities and other coal users find themselves in the unenviable position, again, of appearing to care less for the environmment and the people who must live there, than about their profits.

If utilities hold out for coal cleaning because it offers promise of eliminating both sulfur *and* nitrogen oxides, and reducing customer costs as well, they're accused of wanting to maintain the status quo because they don't care enough about their customers' health and well-being to spend money now to clean the air. That the recent report of the utility-industry's acid-rain monitoring program (see p. 20) indicates no change in acidity of rainfall in the east and midwest over the past seven years is not likely to be accepted by environmental groups as being anything but a self-serving exercise. Utilities, environmentalists would argue, are stalling.

Besides, say environmentalists, who knows if coal cleaning will *ever* be a practical, effective technology. What would happen if nothing is done to further clean up the air we breathe, and 20 or 30 years downline even utilities should be forced to admit that coal cleaning technologies don't work? Better, they say, to address the problem now, with today's tools, and begin to make some progress toward cleaning up the mess utilities and industry have created. (Isn't it interesting so little is said about the automobile's role in creating polluted air?)

The only alternative to scrubbers today, as everyone knows, is to burn low-sulfur coal. But most low-sulfur coal is mined in the West and is difficult, time-consuming and expensive to transport, and can't be burned in just any boiler without expensive modification. In addition, even low-sulfur coal burning may not be sufficient to meet new Clean Air Act requirements after Congress gets done with its rewrite of the legislation. Moreover, a more concerted switch to low-sulfur coal could contribute to massive unemployment in Eastern high-sulfur coal areas, which could be unacceptable to Congress.

So it would appear that if more stringent Clean Air legislation is passed, the only viable approach may be to require more scrubbers..and more investment.

Catch 22 arises because only large-scale R&D effort can ultimately bring coal cleaning to commercial status. The federal government could provide as much as $3- to $4-billion, but federal clean-coal R&D money must be matched by industry R&D investment. In order for it to become available, coal users and others will have to come up with their share. But if utilities and other coal users must invest huge sums in more and better scrubbers to meet more stringent clean air standards, there will be little money available to invest to bring about the long-term benefits of coal cleaning that could make scrubbers, and their costly annual financial drain of utility funds, unnecessary.

With few new power plants to be built in the next five years, we have an unusual opportunity to continue the air cleanup activities already started and to accelerate coal-cleaning R&D activities. Hasty Congressional action to rewrite the Clean Air Act, strengthen emission limits and force greater use of scrubbers, would be counterproductive and effectively shut off any possibility of bringing about the greater benefits coal cleaning could provide.

*Robert A. Lincicome, Editor-in-Chief*

# Letters

### Anti-noise technology

Your article on anti-noise technology ("Can anti-noise technology solve noise problems," August *EL&P*, p.32) discussed only the work of Noise Cancellation Technologies, Inc. There are a number of people working on this technology in the U.S., including Nelson Industries, of Stoughton, WI; General Motors Research Labs, Warren, MI; Applied Acoustic Research, State College, PA; Gulf Oil Corp, Pittsburgh, PA; and the University of Houston, Houston TX; as well as ourselves at Angevine Acoustical Consultants, Inc. A number of others are working on it abroad.

We have been engaged in research funded by Niagara Mohawk Power Corp. on cancelling the hum of transmission transformers since 1976 and demonstrated such cancellation to NMPC in April 1982, and to some members of ESEERCO (Empire State Electric Energy Research Corporation) in November 1982. We recently have been awarded a contract by EPRI to continue this research and to produce a prototype system.

Cancellation of noise from a large complex source, like a transformer, over more than a singular point requires a number of channels of cancellation that are designed to work together while providing different cancellation signals on each channel. We do not believe that NCT has developed a multi-channel system capable of doing this, nor that they have demonstrated this capability. So far as we know, we are the only firm currently working on the cancellation of transformer hum to have demonstrated this multichannel capability.

*O.L. Angevine, P.E.*
*President*
*Angevine Acoutstical Consultants, Inc.*
*East Aurora, NY*

### Ed. note:

*EL&P* was unaware of the work done by Angevine Acoustical Consultants. We subsequently have learned that the company has signed a $375,000 contract with EPRI to produce an active system to cancel transmission transformer hum, essentially cancelling sound with sound. This will further the work previously funded by Niagara Mohawk Power, which will continue to provide support for the new effort. Others participating in the project are Technical Design Corp., Manlius, NY; Rushden Consulting & Research, Baldwinsville, NY; and Product Development Services, Fairfield, CT. We anticipate reporting more on this development effort in a future issue of *EL&P*.

### Replacing URD cables

The article in the August issue titled "Time, cost of replacing URD cables can be reduced" states that we use the cable follower for replacing underground residential distribution cables. It is the GuideDrill, and not the cable follower, that we have used and are continuing to use for cable replacement.

The cable follower, in my personal opinion, is now an obsolete tool.

*Robert N. Wells, Jr.*
*Jersey Central Power & Light Co.*
*Allenhurst, NJ*

### GPU recovery

After reading your editorial in th August issue of *Electric Light & Power* I write to express my personal appreciation, and that of the 13,900 employees of the General Public Utilities System, for the thoughtful perspective you presented in "GPU has done much more than survive the TMI-2 crisis."

You clearly recognized the progress GPU has made. Indeed, the GPU system is much stronger as a result of the TMI experience. And, just as important, we never backed away from our obligation to serve.

The industry is changing, and GPU is positioning itself for the challenges of deregulation and competition. Because of the testing experience of TMI and its aftermath, we are ready for the future.

Again, thank for recognizing the broader significance of GPU's recovery.

*William L. Gifford*
*Vice President*
*GPU Service Corporation*
*Parsippany, NJ*

### August Top 100

Just to set the record straight, United Illuminating is not "a newcomer to the system heat rate leaders" as stated on page 20 of Mr. Minner's interesting and always eagerly awaited article (The Top 100 Electric Utilities' Operating Performance, August 1987 *EL&P*).

While UI's 8th place ranking in this year's listing marks a return to the Top 10 systems that we barely missed with an 11th place finish last year, we are very proud of the fact that UI has consistently been ranked high in the Top 10 for system heat rate efficiency since 1981. According to our records,

Continued on page 21


# Electric Light & Power

**EL&P Staff**

**Publisher**
Robert J. (Duke) Kiesel

**Sales Manager**
Arthur L. Rice

**Editor-in-Chief**
Robert A. Lincicome

**Editorial Staff**
Henry Stein, Engineering Editor
Jill F. Minner, Assistant Editor
Mark T. Hoske, Assistant Editor
Dianne Wilson, Editorial Assistant

John Papamarcos, Consulting Editor
William Kenworthy, Legal Regulatory Editor
Ted Pollock, Management Editor

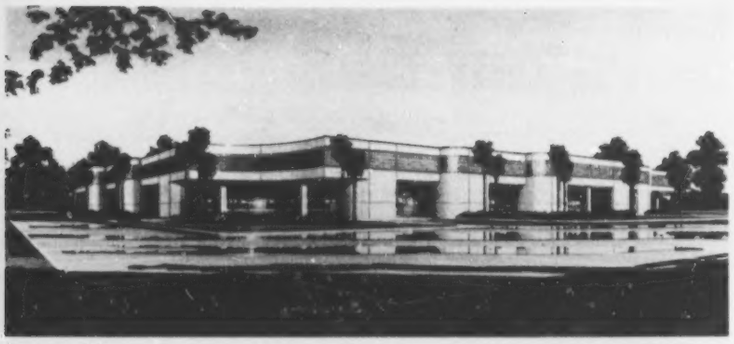
Roberta C. Olmstead, Production Manager
918-832-9368

PennWell PUBLISHING COMPANY

ELECTRIC LIGHT & POWER (USPS 858-860) is published monthly by the PennWell Publishing Company, 1421 S. Sheridan Road, Tulsa, OK 74112. © copyright 1987 by PennWell Publishing Company. All rights reserved. Officers of PennWell Publishing Company are: P.C. Lauinger, Chairman; Philip C. Lauinger, Jr., President; Joseph A. Wolking, Executive Vice President; Joseph T. Bessette, Group Vice President; John Maney, Vice President-Finance. Electric Light & Power editorial offices are located at 1250 S. Grove Avenue, Barrington, IL 60010. Phone (312) 382-2450. Distributed to executives and engineers in U.S. electric utilities and consulting engineering firms. Second class postage paid at Tulsa, OK. Subscription: $38 per year (U.S.), $46 (Canada), $66 (foreign); $108 (foreign air mail). Single issue price: $4 + postage ($5 + postage Canada, and $7 + postage foreign). Copies of back issues are available on microfilm from Univ. Microfilm, 300 N. Zeeb Road, Ann Arbor, MI 48106, and on microfiche from Micro Photo Div. of Bell & Howell, Old Mansfield Road, Wooster, OH 44691. Postmaster: Send address change to ELECTRIC LIGHT & POWER, P.O. Box 2680, Tulsa, OK 74101.

Member ABC Audit Bureau of Circulations. ABP. BPA.


Advertiser and advertising agency assume liability for all contents (including text representation and illustrations) of advertisements printed, and also assume responsibility for any claims arising therefrom made against the publisher. It is the advertiser's or agency's responsibility to obtain appropriate releases on any items or individuals pictured in the advertisement.



## GPU opens tech training center

General Physics Corporation (GPU) has opened a new center in Tampa, FL for training maintenance technicians. Housed in GPU's Tampa Training Center are classrooms, offices and professional training laboratories. The laboratories include a circuit breaker lab, a protective relays lab, an industrial watthour meters lab and a multi-purpose lab. GPU said its programs can provide training to companies that do not have enough personnel available for on-site courses, or to organizations that need specialized training for a small number of people.

## TMI-2 funding coming to an end

PARSIPPANY, NJ—Jersey Central Power & Light Co. received permission from the New Jersey Board of Public Utilities to reduce its retail rates to reflect the end of collection of funds for cleanup of Three Mile Island Unit 2.

But the commission rejected the JCP&L proposal to start collecting for the eventual decommissioning of TMI-2. The BPU said it had determined that the cost of decommissioning was a recoverable expense, but that the utility should not ask for the increase in base rates yet.

The retail rate reduction will be $13.6 million, or about 1.1 percent. It was expected to have no impact on the company's earnings.

JCP&L filed for a net rate reduction of $12.1 million, reflecting the $13.6 million reduction for cleanup funding and a $1.5 million increase to fund the decommissioning of TMI-2.

The BPU first approved customer participation in funding the cleanup in 1982. Jersey Central collected about $13.6 million a year under that approval, for a total amount collected of $61.25 million.

The regulatory agency also adopted performance standards that apply to the Oyster Creek Station and Three Mile Island Unit 1. The standards establish a system of rewards and penalties that are determined by the combined average annual capacity factor of Oyster Creek and TMI-1.

If the two units reach a capacity factor of 40-60 percent, the utility will be penalized with a disallowance of 20 percent of the replacement power costs. If they achieve a capacity factor of 80 percent or above, it will be rewarded with an additional 20 percent of replacement power costs.

## Top 100 report correction

**GPU.** The heat rate listed for General Public Utilities was only that for its nuclear facilities. Total system heat rate, for all fuels, should have been listed as 10,547, which would have put the company in 43rd position among the Top 100 utilities.

GPU figures for transmission mileage appearing in the August Top 100 report were in error. GPU had 2120 circuit miles of 189 kV or higher rated lines in operation at the end of 1986, not 1868 as published. It was operating 4435 circuit miles of lines below 189 kV, instead of the 3985 shown in the table. The additions during 1986 also were listed in error, totalling 33 and 8 for the two ratings, respectively.

**DECo.** Transmission mileage figures were incorrectly listed. For lines rated 189 kV and above, figures published as circuit miles actually were *pole* mile distances, which were subtracted from actual *circuit* miles listed in the 1986 Top 100 report and erroneously showed reductions. DECo in 1986 operated 968 circuit miles of transmission lines rated 189 kV or above, the same as a year earlier. Circuit miles of transmission rated below 189 kV and above 22 kV were 4441, up 17 miles from a year earlier.

## Letters . . .
from page 4

your survey has us ranked as follows in recent years:

| Year | Rank | Btu/kWh |
|---|---|---|
| 1981 | 5 | 10,066 |
| 1982 | 4 | 9,979 |
| 1983 | 3 | 9,909 |
| 1984 | 5 | 9,956 |
| 1985 | 11 | 10,054 |
| 1986 | 8 | 9,934 |

As we've noted in a press release concerning the survey rankings and results, the primary reason for last year's slight decline to 11th place was UI's different and more diversified energy fuel mix achieved during 1985 when we successfully converted our Bridgeport Harbor Station Unit 3 from oil to coal, providing substantial customer savings and a significant reduction in UI's previous oil dependency.

Thanks for your usual fine job and an outstanding publication. We appreciate the chance to set the record straight.

*Jack C. Dolan*
*Manager—Public Information*
*United Illuminating*

of that data. There's already an extensive library of engineering applications for IBM processors like the IBM 9370. Plus, a wide variety of graphics and PC-based terminals can let you develop your own applications (with compatibility to IBM's largest computer—the IBM 3090).

And, with IBM you won't have to give service and support a second thought.

For more information, and an illuminating case study of how Idaho Power Company is benefiting from the IBM ESC today, simply call 1-800-IBM-2468, ext. 18.

The IBM Engineering Support Center—any other system could leave you in the dark.

IBM

Inquire R.S. 10